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Exploring the impact of descriptive norms on pro-environmental behaviour in a university campus

Gallagher, Elaine

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Exploring the impact of descriptive norms on pro-environmental behaviour in a university campus

Elaine Gallagher

A thesis submitted for the degree of Doctor of Philosophy

University of Bath

Department of Psychology

January 2018

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Thesis Abstract

Climate change and the environmental consequences of human behaviour are topics of increasing importance both on a local and global level. In recent times, greater focus has been placed on the necessity to reduce individual behaviours which are detrimental to the environment. In line with this, the current thesis aimed to evaluate the effectiveness of using a descriptive normative intervention to impact environmentally significant behaviours in the context of a university setting. Social norms have been shown to be a highly effective mechanism for behaviour change in previous research, while also being relatively easy to implement and target wide audiences, and were therefore deemed a suitable method to employ to meet the aims of the thesis. Early research in the thesis explores the use of a simple descriptive norms intervention to reduce energy consumption in the chemistry labs. Using normative information about others universities' lab behaviour, it was found that lab users significantly reduced the amount energy wasted through leaving fume hoods open when not in use. In order to ensure that this change in behaviour was not confounded by the presence of the researcher, a replication was conducted. This replication appeared to show less convincing responses to the social norm, with possible interpretations of this discussed. This raised the question of how social influence functions in the absence of an audience or monitor, leading to the novel issue of private behaviours. Subsequent exploratory research indicated that individuals have misperceptions relating to a range of consumptive behaviours, with greater uncertainty about how others behave in private, in particular. These findings illustrated the importance of descriptive normative feedback to correct these misperceptions, as well as the impact of monitoring and visibility to regulate behaviour. This led to a further field study which targeted the private behaviour of showering. A descriptive normative intervention was applied to determine if normative influence was effective in private settings. It was found that norms functioned effectively to impact shower duration, with those told they were taking shorter showers than the norm increasing, and

those told they were taking longer showers than the norm decreasing their shower time. The thesis concludes that in settings such as the workplace or other contexts where there is no personal incentive to change, behaviour change may be possible through the application of descriptive normative interventions. The thesis also points out the importance of the field of private behaviours for future exploration in terms of environmentally beneficial outcomes.

Chapter 1: Introduction

Environmental behaviour change is a topic of growing prevalence of late, with individuals becoming increasingly aware of their own behaviours and how those behaviours serve to impact the environment in both positive and negative manners. Despite the shift towards more conscientious consumption and sustainable lifestyle choices there are still vast swathes of behaviours, which have remained relatively untouched with regard to personal attempts at behaviour change. The field of social psychology has evidenced a broad focus on a number of socially beneficial and environmentally significant behaviours in recent decades. The issue of climate change has ensured that beyond policy and legislative change and improvements in technology, individual behaviour change is a key requirement in tackling the increasing carbon footprint and global aims to reduce the impact of human behaviour. However, promoting individual behaviour change can be a difficult task, particularly as individuals may feel that there is no personal benefit associated with more conscientious behaviour and there may also be a sense that individuals should not feel compelled to make an effort if others continue to consume excessively.

The University of Bath is dedicated to reducing the carbon footprint associated with university-wide operations. To that end, the current research was funded by the Department of Estates in an attempt to establish methods for effective behaviour change which are informed by scientific research. Specifically, through this PhD, the University endeavours to reduce the current carbon footprint and environmentally harmful behaviours using applied psychological behaviour change interventions. In line with the 2008 Carbon Act, it is important that the university takes suitable measures to ensure that the campus is operated in a sustainable manner, from both an operational and individual user perspective.

A wealth of literature on social norms and normative influence is currently available with much of the seminal research in this field being conducted by Cialdini. His work illustrated

the utility of social norms with regard to promoting behaviour change with a particular focus on environmentally important behaviours. The development of the focus theory of normative conduct (Cialdini, Reno, & Kallgren, 1990) was an important addition to the field of normative influence, as this highlights the importance of making the desired behaviour salient in order for behaviour change to occur. Further, the distinction of injunctive and social norms allowed for a greater understanding of the two distinct behaviour change paths which may occur as a result of normative influence.

However, despite the currently available literature, there still exist some gaps in the literature in terms of the contexts within which social norms are effective. In order to address the aims of the researcher and the University of Bath, it is important to explore this issue further. While it is evident that social norms function effectively as a mechanism of behaviour change, the literature to date has not explicitly addressed the utility of descriptive norms in contexts whereby there is no incentive to change, nor with regards to private behaviours. As much of the carbon intensive behaviours which are engaged in in the University of Bath relate to laboratory based activities, and individual behaviours in residences, it is important to explore these contexts further. Due to the relative simplicity of application of normative interventions and the ease with which target individuals can engage with these strategies, should it be shown that descriptive norms are effective in these settings this may offer alternative strategies to promote behaviour change in universities and other workplaces.

Therefore, from a theoretical view, the current thesis aimed to further the literature on social norms and normative influence. The main aim was to explore the contexts where social norms may or may not be effective, which, in the case of the current thesis was the workplace and the private context of the home. In both of these contexts there is no incentive to change behaviour, for example, though reduced bills, as is the case in some previous research. The thesis also explored the possibility of eliciting pro-environmental behaviour

change without the necessity of framing a social norms message environmentally. Therefore, the research will demonstrate if the use of descriptive norms are powerful enough to change behaviour without the need for the inclusion of outcome specific messaging in a real world setting.

Accordingly, the current thesis will explore further application of social norms and focuses on environmentally impactful behaviour change in two key contexts within which a number of environmentally significant behaviours occur. The research herein will focus on behaviour change through the use of descriptive norms on private behaviours, as well as in the workplace whereby there may be no personal incentive to change. The thesis will therefore examine the private behaviour of showering, as well as workplace energy consumption. Due to the consumptive and potentially harmful environmental consequences associated with engagement in these behaviours, it was deemed that they would be suitable to explore. Both energy and water consumption are amongst some of the common behaviours which are typically considered with regard to individual actions which can be targeted for pro-environmental behaviour change and were therefore explored within this thesis. More specifically, the main aims of this PhD were to:

- (a) firstly, establish behaviours which may be suitable for a behaviour change intervention.
- (b) following this, the aim was to plan, develop and implement interventions addressing these behaviours.
- (c) finally, the findings of these intervention studies should be used to make future recommendations and applied more widely.

Therefore, it is important to select a suitable behaviour change strategy which is likely to be effective in the University setting and which may be effective in terms of achieving the aims of carbon footprint reduction beyond the currently available methods.

1.1 Thesis Structure

The thesis is structured into six chapters (traditional format) which include background preparation, exploratory investigation, applied work and conclusions. A more detailed description of the structure and each of the chapters is outlined below.

1.1.1 Chapter 1 (background, the current chapter) provides some background information relating to the thesis in terms of both the content and structure. The chapter also outlines the rationale for undertaking the research and the chosen methodology which will be undertaken in this thesis.

1.1.2 Chapter 2 (background) presents the general literature review. This provides the reader with much of the current relevant literature on the topic of social norms and pro-environmental behaviour change, terminology and definitions. The chapter also describes the issue of targeting individuals who have no incentive to change behaviour. The literature review will provide a suitable background to the subsequent experimental chapters and will highlight some of the existing gaps in the literature which this thesis will aim to address.

1.1.3 Chapter 3 (applied) consists of a two-study chapter, presenting an applied quantitative piece of research which explores the efficacy of a descriptive social norms intervention in a workplace setting in the absence of any incentive to change behaviour. The behaviour of fume hood closure was targeted as it has been shown that within the chemistry labs, fume hoods are often left open which results in excessive amounts of energy wastage. Closing fume hoods is a relatively simple action and one which has the potential to respond appropriately to an intervention as this behaviour is not time consuming, difficult, nor does it impede the lab users ability to conduct their work safely. In fact, increased closure of the fume hoods will result in a safer working environment, as this will ensure that harmful chemicals and fumes are safely and efficiently removed from the vicinity of the lab users. This behaviour was chosen as it has the potential to make a significant impact to the

carbon footprint of the operations of the Chemistry Department, and may result in spill-over effects to other behaviours. This study also has the potential to demonstrate the effectiveness of a social norms intervention in the workplace. More precisely, the chapter investigates if significant energy savings can be achieved in the Chemistry laboratory through the use of descriptive norms relating to the behaviour of lab users in other universities with reference to closing fume hoods when they are not in use. Following the initial study, a replication is also carried out in order to establish the impact of the presence of the researcher on the outcome. Both studies utilise a multi-level modelling approach for data analysis in order to establish changes in energy consumption across time.

1.1.4 Chapter 4 (investigative) presents a two-part online study, which investigates the extent to which individuals' perceptions of how others behave is similar to their own self-reported behaviour across a variety of common behaviours. Forty-four behaviours which has varying levels of environmental impact were used to help establish which types of behaviours may be more susceptible to normative misperceptions. This helped to identify which behaviours would be most suitable to target with a normative intervention. The study also included a separate group of participants who rated these behaviours on perceived privacy, environmental impact, and levels of discomfort association with others being made aware of the manner in which they engaged in these behaviours. The exploratory study addresses a number of hypotheses relating to normative perceptions and misperceptions and explores the significance of private behaviours in terms of how the privacy level of a behaviour may impact on our awareness of what is 'normal'. The study makes use of correlational analyses to explore relationships and similarities, as well as comparison of means to establish differences between perceptions and actual behaviours.

1.1.5 Chapter 5 (applied) presents a further field study which is informed by the findings of the previous chapters. This study aims to determine if social norms are effective in private settings in the absence of a referent group or behavioural guide. Specifically, the study addressed the private behaviour of showering in on-campus residences. The behaviour of showering was targeted as household water consumption constitutes a significant portion of all water used. The current global threat of water shortages and droughts, as well as a growing population indicate that it is important to ensure that water is being used efficiently. On an individual level, shower duration varies significantly. This suggests that for many, there may be room to improve on existing shower duration so as to reduce individual water consumption. Furthermore, the behaviour of showering was also targeted as it was shown in Chapter 4 that private household behaviours may be susceptible to normative misperceptions and therefore, would benefit from a corrective social norms intervention. However, as social norms have not typically been used to address private behaviours, their effectiveness in this context was also explored with regards to showering. In order to preserve scientific rigour, the study employed various randomised controls and a neutrally framed message, in order to establish if shower duration can be impacted through the use of a descriptive norms intervention in the absence of a referent social group and without any personal incentive to change behaviour. This study measured changes in shower duration from baseline to intervention following the provision of normative information, using objectively measured shower data.

1.1.6 Chapter 6 (conclusions) provides the general discussion which draws on the main findings, applications and challenges encountered during the course of conducting this research. This chapter presents the key recommendations with regard to application and some areas for future research. It also and summarises the main limitations which were encountered and concludes the thesis.

1.2 Methodology

The current thesis aimed to utilise applied interventions in order to suitably measure behaviour change while also carrying out high quality research which will add to the current literature on behaviour and behaviour change. The decision to use applied interventions was based on the aim of the PhD to explore methods which could achieve a reduction in carbon footprint and environmentally harmful behaviours. To that end, the use of applied research allowed for the evaluation of problem solving methods to be explored and their effectiveness measured objectively, without any potentially biased responding or confounding factors which may be present when using self-reported survey, for example. The use of applied research demonstrated the efficacy of the descriptive norms intervention in real-world settings which can be validated for application in other settings. Accordingly, it was determined that the most appropriate method to follow which would appropriately address the aims and to evaluate the effectiveness of applied interventions was through an entirely quantitative format.

The use of a purely quantitative approach ensured a variety of benefits for the research. This ensured a more systematic approach to the research which allows for ease of replication and objective, unbiased analysis of data. The findings of quantitative research are likely to be more widely useful as this method enhances the generalisability of the results. Using a quantitative approach also permits replication of the research to determine changes in findings over time. While the limitations of such an approach must be addressed, such as the absence of in-depth exploration relating to why individuals respond to an intervention in a certain manner, it was deemed that within the scope of the thesis, a quantitative method was more appropriate.

1.3 Ethical Considerations

Each piece of research undertaken as part of this thesis received full ethical approval from The Psychology Ethics Committee (University of Bath). Individuals who participated in

online and field studies were informed of the aims of the research and given the right to have individual data withdrawn. Individuals were advised that their anonymity would be protected should they wish to take part in both surveys and applied research.

1.3.1 Data Collection

Individual data collection was conducted predominantly online, through the use of online surveys and questionnaires. Energy data used in Chapter 3 was obtained from Variable Air Volume records as provided by the University of Bath Carbon Manager. This data was provided on a lab basis, and therefore not possible to link to any individual within the lab. The remaining data which was gathered for Chapter 5 was collected manually by the researcher using data logging devices. These devices did not display any information to participants and the data which was logged was anonymised using reference codes which were only known to the researcher.

Data analysis was undertaken in the University of Bath using password protected computers. Data was only available to the researcher and supervisory team. It was anticipated that there would be minimal risks associated with the data collection process due to the nature of the research being conducted. However, an option to have data removed or to cease participation was offered to individuals in all cases.

1.4 Conclusion

The current chapter aimed to provide the reader with suitable information pertaining to the reasons for conducting this thesis. Furthermore, the aim was to provide justification for the use of a quantitative approach to address the aims of the thesis. Finally, the present chapter was intended to illustrate how the chapters and studies presented in this thesis form a coherent story and serve to complement each other while suitably addressing the aims of the University while also exploring novel methods with regard to behaviour change.

Chapter 2: Literature Review

2.1 Abstract

In order to provide suitable background and context for this thesis, a review of the literature was completed. The current chapter will critically discuss a range of previous literature in the field of social norms and normative behaviour change. The review will draw on the importance of the focus theory and its relevance in terms of the efficacy of social norms campaigns. There will also be focus on the phenomenon of normative misperceptions and how this occurrence may serve to influence behaviour. The chapter will finally draw on potential barriers to behaviour change, with a focus on contexts where there may be no incentive to change. The chapter will address the gaps in the current literature in the field of pro-environmental behaviour change and normative influence prior to their exploration in subsequent chapters.

2.2 Introduction

This literature review aims to provide a suitable background and justification for the use of social norms as a behaviour change mechanism which will be explored throughout this thesis. The specific focus of this thesis is exploration of the efficacy of using descriptive norms as a behaviour change strategy aimed at reducing environmentally harmful behaviours in contexts where there is no personal incentive to change, or where the normative behaviour may not be focal. While an extensive range of research has utilised a social norms approach to elicit behaviour change in recent decades, much of the practical application of this approach has failed to explicitly address the usefulness of this method in real world settings and in terms of their long term behaviour change ability. To that end, the current chapter will draw on previous social norms literature, with a particular focus on research targeting environmentally significant behaviours. The review will explore the factors which may influence the degree of susceptibility to normative influence and factors which are at play. The chapter will also explore some of the potential barriers to behaviour

change which should be considered prior to the implementation of any intervention, before drawing on some of the criticisms of previous social norms research.

2.3 Social norms

Social norms have been shown to be a powerful and effective source of social influence (e.g., Cialdini, Kallgren & Reno, 1991; Berkowitz, 2004; Goldstein, Cialdini, & Griskevicius, 2008), and are useful in that they serve to provide individuals with information on how to behave in particular situations which in turn informs individuals about the social reality in that situation (Aarts & Dijksterhuis, 2003). Social norms tell us how others behave when we may be mistaken or lacking in knowledge about how certain behaviours are carried out. Social norms function by way of indicating what the accepted manner of behaviour in a given setting is, and serve to govern behaviour in these settings to some extent. Bicchieri (2006) provides a comprehensive definition of social norms which suitably captures the complexity of the influencing mechanism, as follows: “...*a norm can be formal or informal, personal or collective, descriptive of what most people do, or prescriptive of behaviour. In the same social setting, conformity to these different kinds of norms stems from a variety of motivations and produces distinct, sometimes even opposing, behavioural pattern...*” (p.1).

The phenomenon of social influence has long been recognised and used as a reliable and robust source of behaviour change (e.g., Berkowitz, 2004; Larimer & Neighbors, 2003; Cialdini et al, 1991). Put simply, social influence is the change in behaviour in an individual which is brought about by the behaviour of another individual or group (Breckler, Olsen & Wiggins, 2005). Social norms relate to what the common behaviour is in a given social context or situation and these normative behaviours serve to provide a guide to individuals in relation to what the accepted actions are. This helps individuals to ascertain the ‘social reality’ which will inform decisions on what are the most appropriate behaviours in a given situation, as defined by group norms (Aarts & Dijksterhuis, 2003). These social interactions and influences are important processes, as individuals are at least partly shaped by these

situations and experiences (Triandis, 1989), and they have been identified as being more powerful sources of influence than culture, personality, family, religion and biology (Perkins & Berkowitz, 1986; Perkins, 2002).

According to Bicchieri (2006), in order for normative social influence to occur, two conditions must be present, namely; that a sufficient portion of the given population are aware of the norm in the situation to which it applies, and that individuals prefer to conform to social norms and rules in that context. The normative behaviour is determined by the individual as a result of an evaluation of the information available from observable behaviours, direct and indirect communication relating to the behaviour, and one's knowledge of the self (Miller & Prentice, 1996).

By engaging in and responding to the group norm, or indeed ignoring it and behaving in a counter manner, individuals can experience both rewards and sanctions, respectively. These are likely to be in the social realm and would relate to group membership and social approval by the group for those that engage in the normative behaviour (Terry, Hogg & White, 1999). For those that ignore normative behaviour this may result in sanctions such as group exclusion, rejection and social disapproval (McKenna, 2000). Social normative influence may occur strongly in those who wish to become part of a group, as well as for those that are already members who wish to remain part of the group. Schlenker (1985) discussed desired and undesired identity images in the context of how they can be altered by social norms. Normative behaviour can be linked to this, as in order to alleviate undesirable images, individuals may engage in the behaviour of the desired group to achieve the status of a desired identity image.

Ultimately, the plethora of research available on social influence demonstrates that we look to others to guide our behaviours, and learn what is expected and accepted through observation of referent social groups. The phenomenon of social normative influence will be discussed below, and will draw on a range of relevant literature, beginning with classical

studies which demonstrate the early literature on social influence. The important distinction between injunctive and descriptive norms will also be presented, before illustrating the prevalent issue of normative misperceptions. Social norms have been shown to be useful in the field of environmentally significant behaviours, and this will be discussed further before presenting literature on the manner by which normative messages should be communicated in order to improve effectiveness.

2.3.1 Classic Studies

Early classical theories on social influence provide a useful explanatory background on the manner in which social norms effect the behaviour of others. Festinger's *Social Comparison Theory* (1954), suggests that individuals look to others to guide and evaluate their behaviour against that of others' abilities and accomplishments. The theory posits that an individual's abilities and opinions are self-evaluated by comparing oneself to similar others which in turn serves to reduce uncertainty as to how they should then behave. Individuals use the social comparison process in order to determine their standing amongst others, by way of a downward comparison to those they believe are worse than them in a given context, and upward comparison to those who are believed to be better than them, in a specific context. This concept of downward comparison was later further developed by Wills (1981) who asserted that downward comparison can have both positive and negative impacts on an individual. It was suggested that while an individual may be disappointed to learn that they do not perform to the standard of those they are evaluating themselves against, this may serve to motivate the individual to improve and achieve. Despite this theory emerging over half a century ago, it would appear that the teachings of social comparison theory are still relevant currently. Contemporary research has shown social comparison at play with regard to body image (Carlson Jones, 2001) and household consumption (Karlsson, Gärling, Dellgran, & Klingander, 2005) for example. However, Buunk and Gibbons (2007) noted that there is little in the literature relating to social comparison in an organisational context.

Social Learning Theory (Bandura, 1977) describes a similar mechanism of behavioural influence, and is based on the assumption that individuals look to others to guide their behaviour and to determine what the correct or popular behaviour is in a particular situation. Social learning theory incorporates the three key stages of observation, imitation and modelling. The individuals being observed by others are known as models, and may include friends, family, colleagues, celebrities, peers, teachers or others. According to Bandura (1977), individuals look to these models and observe their behaviour, developing an understanding of how the observed model carries out the behaviour. This knowledge is then stored by the individual until such time that they wish to put it into action. For this to be carried out effectively, four conditions must be in place, namely; attention, retention, reproduction and motivation. *Attention* is necessary for learning to take place, with various factors influencing how much attention is paid, such as novelty or complexity, as well as individual factors such as arousal and sensory capacities (Bandura, 1965). *Retention* describes the amount of information which is remembered and available for recall from the attention stage and includes aspects such as mental imagery and cognitive organisation. *Reproduction* of the behaviour occurs when the behaviour is correctly replicated as a result of sufficient attention and retention of the observed behaviour. Finally, *motivation* is the drive or incentive which results in the desire of an individual to engage in the behaviour, with potential reinforcement occurring if the behaviour is rewarded, or punishment if the behaviour is not carried out correctly.

A phenomenon known as vicarious reinforcement occurs within the social learning theory whereby individuals look to similar others to observe the consequences or outcomes of deciding whether to follow or ignore the behaviour of a potential model (Bandura, Ross & Ross, 1963). This provides a strong enforcer for the individual to make a rational decision to engage in the behaviour or not, depending on the award or punishment that is likely to be received based on observation of others engaging in or avoiding the behaviour. Recent

literature has shown that the theory still has relevance in contemporary society, with Bandura (2001) describing its links with regard to social cognitive theory and communication.

Asch's *Social Conformity Theory* (1951) is a further relevant classic theory which highlights the extent to which social pressure can elicit behaviour change. His early studies show that in a group context, an individual is likely to respond in the same way as the other members of the group, even when aware that the response is wrong. It was found in interviews subsequent to the studies that individuals conformed to the incorrect responses of the group in an attempt to avoid being singled out as different, and also as they felt that because everyone else gave the same incorrect answer, that the individual themselves might be wrong or lacking in information. There has, however been some criticism of Asch's early studies in terms of reliability. Perrin and Spencer (1980) attempted to replicate the findings using a more varied sample and found the effect was not present. This may be due to a change in attitude relating to the acceptability of 'being different' which would not have been the social norm during the time of the initial studies. Despite this, there are numerous studies from the past several decades which show that individuals, in many cases will conform to the group behaviour, some of which will be outlined later.

These early theories clearly illustrate that individuals generally look to others to guide their behaviour and learn through observation. This shows how relevant the behaviour of others is in terms of understanding what is socially accepted and approved, and ultimately how this has the power to influence behaviour on a broad scale.

2.3.2 Descriptive and injunctive norms

Historically, 'social norms' were used in a general sense to broadly describe the concept of normative social influence without any defining distinction of causes of influence (Larimer & Neighbors, 2003). However, it was highlighted by Shaffer (1983) that the field of social norms and normative influence required a clear conceptual definition of social norms in

order to fully and logically explain and understand the phenomenon. It was stated that this was required as the single term was being used to describe two methodologically different forms of behavioural influence. This oversight was eventually rectified a number of years later by Cialdini and colleagues (1991), with the introduction of the independent terms ‘injunctive norm’ and ‘descriptive norm’. These refinements on the distinction between the two types of normative influence have served to add clarity and understanding to the field with respect to these two methodically differing sources of influence.

Cialdini and colleagues (1991) define injunctive norms as relating to what the approved or disapproved behaviour is and what should be done in a given situation. Injunctive norms are often linked with a sense of morality and what is known to be the ‘right thing to do’, as opposed to what is actually done (Kallgren, Reno & Cialdini, 2000). Injunctive norms are generally based on what is widely accepted to be in line with cultural and societal rules, standards and understandings in particular contexts or settings. For example, individuals know that they should not litter the street as this goes against typical standards and expectations. Cialdini and colleagues (1990) referred to these as the norms of ‘ought’.

Descriptive norms differ from injunctive norms in that they refer to what is actually done, irrespective of what is commonly approved or disapproved of (Cialdini et al., 1991). Cialdini and colleagues (1990) referred to these as the norms of ‘is’, as they represent what is done, regardless of individuals knowing it is not necessarily the moral or outwardly socially acceptable behaviour. Descriptive norms may be in direct conflict with the injunctive norm in certain situations. For example, seeing that the street is littered tells us that the descriptive norm in that context is that littering is a behaviour which others engage in, despite the injunctive norm being to not litter the street. This example was demonstrated by Cialdini and colleagues (1990) study, whereby a littered environment appeared to suggest the acceptability of the behaviour.

By following the descriptive norm in a behavioural context, an individual can be relatively confident that this behaviour is widely accepted by referent others and ensures they are making an acceptable, or at least tolerated choice (Cialdini et al., 2006). Following this strategy ensures that individuals will be unlikely to experience social sanctions as a result of their behaviour. Injunctive norms, on the other hand, are more likely to result in social rewards and punishments depending on the individual's adherence to the norm. Jacobsen, Mortensen and Cialdini (2011) have suggested that descriptive norms are more influential to individuals whose attempts at self-regulation are not entirely successful, while those individuals who meet their capacity to self-regulate and have 'willpower' are more likely to be influenced by the injunctive norm in a situation.

The inclusion of these definitions is an important addition to the theory of social norms and normative influence. This has allowed us to make a clear distinction between the processes involved in injunctive and descriptive normative influence, as depending on which type of norm is activated, both may potentially lead to different outcomes in terms of behavioural responses in the same context (Reno, Cialdini & Kallgren, 1993), and occur through different motivational paths (Cialdini et al, 2006). Jacobsen and colleagues (2011) describe descriptive norms as being relative to an individual's intrapersonal goal of making correct and accurate decisions about behaviours, while injunctive norms are related to interpersonal goals associated with maintaining social approval and building desired social relationships. This highlights the clear differences in the paths to potential behaviour change as a result of these two forms of normative influence.

2.3.3 Normative misperceptions

While the literature has shown that social norms are effective sources of behaviour change, it has also highlighted that often individuals can misperceive norms. Normative misperceptions describe the phenomenon whereby individuals have an inaccurate belief about the way in which referent others engage in a particular behaviour. These

misperceptions can result in the individual either underestimating or overestimating the extent, frequency or manner by which their social group participates in these behaviours. The majority of the literature on normative misperceptions focuses largely on ‘problem’ behaviours which are pertinent to the health of the individuals. The literature draws on some potential explanations for these inaccuracies in normative perceptions which occur, such as pluralistic ignorance, false consensus and false uniqueness, which will be described below.

Research on normative misperceptions appears to show a trend of overestimating the extent to which others engage in ‘bad’ or risky behaviours. For example, Larimer and Neighbors (2003) found an overestimation in gambling behaviours amongst peers by individuals who engaged in gambling themselves. This was also found in a series of studies on alcohol consumption (see Perkins & Weschler, 1996; Lewis & Neighbors, 2004), risky sexual behaviours (Lewis, Litt, Cronce, Blayney, & Gilmore, 2014), seatbelt use (Litt, Lewis, Linkenbach, Lande, & Neighbors, 2014), tax evasion (Bardach, 1989) and sun protection use (Reid & Aiken, 2013). Further similar findings were reported with regard to estimations of drug use, with a positive relationship found between self-reported behaviour and perceived norms (Martens, Page, Mowry, Damann, Taylor, & Cimini, 2006).

The extent of normative misperceptions with regards to various environmentally significant behaviours is not known, nor is the potential impact of any possible inaccuracies with respect to these behaviours. However, it has been shown that individuals tend to overestimate the ‘bad’ behaviour of others (Larimer & Neighbors, 2003, for example) which in turn influences individuals own behaviour (Martens et al., 2006, for example). The extent to which relatively visible behaviours such as college alcohol consumption are misperceived, would raise the question as to the extent to which less visible behaviours are then likely to be subject to normative misperceptions, when there is little to no opportunity to observe engagement in such behaviours. Therefore, it is important to explore this area in

order to understand the extent of, and minimise the environmental impact of normative misperceptions.

Several studies have identified a link between alcohol consumption and misperceptions of norms, with studies targeting college campuses experiencing this trend. It has been shown that students look to their peers to inform their drinking behaviours, however they often overestimate the level of alcohol which is actually consumed by peers (Prentice & Miller, 1993; Campo, Brossard, Frazer, Marchell, Lewis & Talbot, 2003; Perkins, Haines, & Rice, 2005). Similarly, misperceptions of the prevalence of abstinence or low-level alcohol consumption can lead individuals to underestimate the number of peers that engage in these more desirable behaviours, and thus discourage them from these healthier drinking habits (LaBrie et al., 2008). Larimer and Neighbors (2003) have also found a similar pattern with student gambling behaviours, in that individuals tend to overestimate both the frequency of gambling and the amount of money speculated, with social influence being identified as one of the greatest reported reasons for college students to engage in gambling (Neighbors, Lostutter, Cronce, & Larimer, 2002).

The findings that behaviours were overestimated by others who engage in similar behaviours highlights the issue with normative misperceptions. It would appear to suggest that, particularly in the case of risky or harmful behaviours, these misperceptions may to some extent normalise increased engagement in these behaviours. To that end, these misperceptions of undesirable behaviour are an important consideration and this may pose a wider societal issue. It is evident from the classic studies outlined above that the human condition results in a desire to be similar to others. These misperceptions therefore have the potential to result in a self-fulfilling prophecy of sorts, whereby the incorrectly perceived norm will influence behaviour to the extent that this eventually becomes the true norm.

The literature on normative misperceptions has identified three main types of normative misperceptions. Firstly, pluralistic ignorance describes the phenomenon whereby

individuals incorrectly believe their private behaviour to be different to that of their peers (Miller & McFarland, 1991). This results in individuals altering their behaviour in order to align their actions more closely with what they perceive to be the norm. Individuals are conscious that their behaviour is not in line with their private sentiments, yet they do not appear to make the same assumptions about others in the same context, and rather consider that the behaviour of others reflects their true attitudes and beliefs (Prentice & Miller, 1996). Their desired behaviour may then be suppressed as a result of the belief that it is not widely engaged in (Miller & McFarland, 1991). This behaviour alteration may occur as a result of embarrassment associated with behaving in a manner which is incorrectly perceived as being contrary to the norm (Berkowitz, 2003). This misinterpretation usually occurs in situations whereby there may be widespread misrepresentation of individuals private attitudes and behaviours (Prentice and Miller, 1993).

False consensus is another common cause of normative misperceptions. This occurrence has been described as being somewhat contrary to pluralistic ignorance (Prentice & Miller, 1996). False consensus arises when an individual has the tendency to overestimate the degree to which their own behaviours, attitudes and beliefs are also true of others (Marks and Miller, 1987; Ross, Greene, & House, 1977). Berkowitz (2003) posits that false consensus can also operate to support an individual's denial that a potentially undesirable behaviour may be somewhat problematic or out of the ordinary, and provides a sense of justification for this behaviour. According to Bauman and Geher (2002), individuals may use this incorrect information about the behaviour of others to guide their own behaviour. For example, research has found that individuals who engage in tax compliance show greater incidences of perceived tax evasion of others, resulting in more favourable attitudes to the activity based on their belief that the behaviour is more widespread than it actually is (Wenzel, 2005). Wenzel draws on the private nature of taxpaying practices as one explanation for individuals' misperception of the prevalence of tax cheating, which

highlights the importance of the visibility of a behaviour in order for accurate normative perceptions to occur.

This type of misperception is likely to have a greater influence on individuals that engage in the behaviour excessively or more frequently, than those that only rarely or moderately do so (Page, Scanlon & Gilbert, 1999). According to Toch and Klofas (1984), the strongest views in a community are often held by individuals experiencing false consensus, which can be problematic if they persuade others to adopt their opinion. Of course, in the case of positive or socially beneficial behaviours, false consensus or an overestimation of the frequency of others' engagement in behaviours can be beneficial as it may encourage others to engage in desirable or socially beneficial behaviours.

False uniqueness is the third of the three identified varieties of normative misperceptions. False uniqueness describes a situation where an individual incorrectly believes that their behaviour is different to everyone else, when in fact it is not (Suls & Wan, 1987). Somewhat contrary to pluralistic ignorance, false uniqueness is experienced by the individual in a positive light, as it allows individuals to believe that their behaviour is special or desirable to some degree. Those who engage in said desirable behaviours appear to underestimate the extent to which referent others also engage in similar good behaviours (Monin & Norton, 2003). For example, an individual who practises veganism may believe that this is more uncommon than it actually is, providing feelings of eminence.

These discrepancies which have been found to be present in a variety of behaviours demonstrate not only the extent to which individuals are inaccurate in their understanding of others relative to themselves, but also that there is the potential risk of a consistent behavioural influence which may occur as a result, with evidence that these misperceptions can in fact predict behaviour (Rimal & Lapinski, 2015). To that end, normative misperceptions and the extent to which these misperceptions occur are an important area to focus on, particularly for behaviours which are seen as personally problematic, as well as

those which may have an impact beyond the individual. The majority of literature on misperceptions of social norms, however, has focused on behaviours which are personally harmful, as outlined above. To date however, there appears to be little in the literature which examines the extent of normative misperceptions pertaining to behaviours which pose a threat on a larger scale, such as those behaviours which are harmful for the environment, for example.

2.3.4 Social norms and environmental behaviour change

One of the key areas of focus for behaviour change in the field of social psychology is that of environmentally significant behaviours. Due to the increasing urgency surrounding the need to establish suitable behaviour change methods which can effectively target environmentally detrimental behaviour it is important that potential solutions are explored. However, social norms have been identified as being an underutilised tool in the quest to reduce those behaviours which are seen as harmful to the environment (Griskevicius, Cialdini & Goldstein, 2008), yet the literature would suggest that they are highly effective in terms of their ability to change behaviour (e.g., Hopper & Nielsen, 1991; Neighbors et al., 2002; Reno et al., 1993; Schultz et al., 2007). This is promising in terms of the development of interventions to tackle climate change and carbon footprint reduction, in addition to the fact that social norms campaigns are relatively easy to implement and they are not costly in terms of set-up (Griskevicius et al., 2008). As both early and recent literature on social influence demonstrates that individuals look to others to guide their behaviour, it would appear a promising strategy to follow in terms of attempts to achieve pro-environmental behaviour change in an effective and efficient manner.

A plethora of literature to date has shown how effective social norms campaigns have been in the past in terms of their ability to influence environmentally significant behaviours. It has been shown that social norms have been successful across a diverse range of environmentally significant behaviours, illustrating their versatility and usefulness in the

field of socially beneficial behaviours. For example, social norms campaigns using descriptive norms have been shown to influence such environmentally impactful behaviours as transport choice (Heath & Gifford, 2002), towel re-use (Goldstein et al, 2008) and recycling (Hopper & Nielsen, 1991). Injunctive norms have been found to be effective with regards to littering (Reno et al., 1993) and theft of natural artefacts (Cialdini, Demaine, Sagarin, Barrett, Rhoads, & Winter, 2006), while household energy use (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) has been successfully reduced using a combination of both injunctive and descriptive norms. The literature has therefore shown normative interventions to be a robust mechanism for behaviour change, with substantial success in the field of pro-environmental behaviour change, and as they can be wide-reaching and easily implemented, it would appear to be an obvious strategy to pursue for attempts to change environmentally impactful behaviour.

These studies illustrate the variety of contexts within which social norms have been shown to be effective in relation to behaviours which impact the environment. They also outline the diversity of environmentally significant behaviours which appear to be susceptible to the influence of social norms. These studies serve to strengthen the view that normative influence and social norms interventions are likely to be highly appropriate with regard to pro-environmental behaviour change, and that this behaviour change method possesses adequate utility and power in order to reduce the incidence of actions which are harmful to the environment. Communicated in the correct manner while taking into account other factors which may influence the impact of normative influence, social norms interventions have the potential to continue to make a positive difference in line with the aims of the University to reduce carbon intensive behaviours.

2.3.5 Communicating normative Messages

Attempts at corrective social norms marketing have grown common in recent years as it has become apparent, as outlined above, that individuals use these normative misperceptions as

meaningful guides for their own behaviour (Schultz et al., 2007). Social norms campaigns therefore attempt to rectify this deficit in knowledge and inform individuals through the provision of correct information relating to the common behaviour. These campaigns also aim to inform those engaging in the correct behaviour that they are doing so, in order to ensure that they continue to engage in the desired behaviour. The use of social normative influence is also a beneficial strategy in situations where there may not be any extrinsic incentives available to encourage behaviour change, such as a monetary reward. In any case, extrinsic rewards have been shown to reinforce those behaviours which are linked with environmentally harmful behaviours (Davis, Bagozzi, & Warshaw, 1992), and are therefore not a suitable motivator. For these reasons, the use of social norms would appear to offer a potential solution to the current issue. However, communication and implementation of social norms marketing must be carefully considered in order to avoid undesirable outcomes.

Behaviour change can occur by the use of normative information and messages, provided that the norm is presented in a way that will capture the attention of the observer (Winter, Cialdini, Bator, Rhoads, & Sagarin, 1998). In order to elicit a desired behaviour, norms must also be communicated in an effective manner which makes it clear to the individuals what the expected behaviour is. While it has been identified that the most effective manner by which to encourage behaviour change involves face-to-face interaction (Myers, 1990), it is not always possible to do this on a large scale, such as to diverse audiences in a workplace or campus context, for instance. Therefore, the communicating of normative information which can reach a wide number of individuals would appear to be a logical strategy to elicit behaviour change. However, this seemingly simple task has been found to pose certain difficulties in the past, whereby the presentation of normative information has led to unexpected outcomes such as boomerang effects (e.g. Schultz et al., 2007; Cialdini et al., 2006). Ultimately, this has illustrated that the framing of normative messages is an important

factor to consider for the implementation of any social norms intervention, which must be managed carefully in order to avoid promoting negative or undesirable behaviours.

The *elaboration likelihood model* (Petty & Cacioppo, 1986) which is a dual process model, suggests that if a message has a good argument with a clearly defined process, this serves to enhance the message and promote behaviour change. This is known as the central route and involves careful and critical thinking, and inspection of the message for relevant arguments and their merits in order to make an informed judgement in terms of the persuasive aims of the message. Conversely, messages which are communicated using poor arguments are likely to prevent change (Petty & Wegener, 1999). The second part of this model involves less engaged effort in processing the message and instead relies on positive and negative cues associated with the message or indeed, if the message is communicated by an expert or even the likeability of the communicator (Petty, Cacioppo, & Schumann, 1983). This process has been coined as the peripheral route to persuasion and involves less target-behaviour relevant arguments (Bhattacharjee & Sandford, 2006). Therefore, communication of persuasive messages should avoid ambiguity and also attempt to exploit any supportive peripheral cues which the message could benefit from while strengthening the influence of the message (Petty & Cacioppo, 1986).

As previously stated, there are differing behavioural responses depending on whether the descriptive or injunctive norm is activated (Reno et al., 1993), which must be taken into account when attempting to communicate norms for a desirable behavioural outcome. Therefore, only the norm which is consistent with the goal or target behaviour must be made focal to the intended audience (Cialdini et al., 2006). Cialdini and colleagues (1990) developed the *Focus Theory of Normative Conduct* which describes this phenomenon. In its simplest terms, this theory states that despite other cues in the environment, the aspect of the environment which captures an individuals' focus, is likely to influence them to a greater extent than cues which are not prominent or in focus. According to Kallgren and colleagues

(2000), making the norm salient is most effective when the norm is injunctive, rather than descriptive. This has been deduced from the findings that injunctive norms which are focal encourage pro-social behaviour in a wider range of situations and contexts than descriptive norms.

Therefore, the literature appears to suggest that when attempting to change or reduce a common undesirable behaviour, it is important to draw the individuals' focus to the injunctive norm, as making the descriptive norm focal explicitly states that many people engage in the problem behaviour. However, this is likely to be true only in situations where the descriptive norm illustrates that most individuals engage in the undesirable behaviour. Despite the good intentions behind this type of message, this serves to focus attention on the extent to which the problem or undesirable behaviour is occurring, ultimately exposing the descriptive norm in a manner which has the potential to increase the unwanted behaviours (Cialdini et al., 2006). This was found in Cialdini and colleagues study (2006) which focused on theft occurring at the Petrified Forest National Park in Arizona, whereby the problem behaviour increased when it became known how common it was. Signage at the park indicated that theft was a regular occurrence and asked visitors to refrain from this behaviour. This indicated that the descriptive norm was to take the natural artefacts, and provided motivation for individuals visiting the park to continue to engage in this behaviour. This illustrates that when the descriptive norm represents a problematic or undesirable behaviour, it is better to instead draw attention to the injunctive norm with the intention to alter the behaviour in that direction eventually resulting in the injunctive norm or desirable behaviour, becoming the descriptive norm. Cialdini and colleagues (2006) found that by amending the signage to highlight the injunctive norm, this resulted in a decrease in the undesirable behaviour.

Similarly, Schultz and colleagues (2007) found that providing people with information showing that they are performing better than others in terms of a desired behaviour, can

result in a reduction in the desirable behaviour. This ‘boomerang effect’ (Clee & Wicklund, 1980), occurs when the normative message being presented inadvertently encourages the receiver to increase the unwanted behaviour and reduce the desired behaviour. According to Schultz and colleagues (2007), this occurs as a result of individuals’ intention not to deviate from the norm. With this in mind, it would appear that to accurately craft normative messages which will result in the desired outcome, individuals behaving below the desired behaviour threshold should be exposed to the descriptive norm, while those that are already engaging in the desired behaviour, or exceeding the desired threshold should be presented with a message which combines the descriptive norm with an injunctive normative message (Schultz et al., 2007).

2.3.6 Benefits of social norms interventions

The benefit of social norms interventions is that they have the power to influence a large number of individuals yet in terms of maintenance or resources inputted, there are minimal requirements ensuring that they are also cost effective (Griskevicius et al., 2008). Griskevicius and colleagues (2008) also highlighted social norms as being an underappreciated and underutilised approach to environmentally focussed behaviour change. However, despite the apparent widespread efficacy of social norms interventions, one of the key facets in the effectiveness of normative influence campaigns is the importance of perceived group membership. As social norms persuasive ability is due to individuals not wanting to be seen as different from the referent group, the target individuals must either perceive themselves as part of the group or want to be part of the group in order for the knowledge of the behaviour of the group to influence their behaviour. Should an individual perceive themselves as not being part of the referent group, they are unlikely to be persuaded by the threat of social sanctions or exclusion from the group.

Furthermore, behaviour change strategies typically rely to some extent on the personal attitudes, motivations and conscious intentions of the target individual to perform the

desired behaviour. For example, the theory of planned behaviour (Ajzen, 1991) posits that our actions and behavioural intentions are shaped in part by our attitudes. This can pose a problem where a desired behaviour is environmental in nature if the target individuals are low in environmental concern or rarely engage in sustainable behaviours, particularly as employing an environmentally framed intervention is unlikely to be effective for this group. However, social norms simply appeal to the individuals' desire to behave in a manner which is similar to their peers or referent group (Berkowitz, 2005). In chapter 5, it will be shown that despite participants' self-reported environmental concern and conscientious shower taking, the provision of normative information that others took longer showers than them was sufficiently strong to change behaviour, despite this not being in line with their previous behaviours and self-reported beliefs. Social norms in that sense appear to have a unique ability to change behaviour in the absence of any necessity to appeal to specific attitudes, values or intentions of the target individuals. This is beneficial as it does not require tailored interventions which appeal to values of distinct groups of people, but rather has the ability to influence a large number of individuals by highlighting behavioural differences.

2.4 Factors influencing normative behaviour

Social norms have been shown to be a highly effective behaviour change mechanism according to the extant available literature, particularly with respect to environmentally significant behaviours. Despite the overwhelming evidence for the effectiveness of social normative influence, it has been viewed by several authors in the literature as having little use in terms of empirical value as it could be understood as being perhaps too broad and vague (Darley & Latane, 1970; Krebs & Miller, 1985). While this may seem an unlikely suggestion in light of the numerous studies which show otherwise, it must be taken into account that there are other factors at play which should be considered when implementing a normative intervention. For example, strong personal norms may have the power to override other cues in the environment attempting to influence behaviour (Thøgersen, 1999), and have the potential to have a countering impact on behaviour when at odds with

attempts at social normative influence (Schwartz, 1977). Communication campaigns which explicitly focus on climate change and the negative impact of particular behaviours are likely to have an effect opposite to that which is desired, as by highlighting the impending disaster and focusing on tragic outcomes may serve to paralyse individuals as opposed to empower them into meaningful action (Moloney, Horne & Fien, 2010)

Therefore, social norms should not be considered a blanket solution which can solve complex behaviour change problems, without first taking in to account some of the factors which may influence the effectiveness of a normative intervention. Some potentially confounding factors will be discussed below. It would appear that if careful consideration is given to such factors prior to the implementation of a normative behaviour change strategy that this will likely increase the effectiveness of the intervention while also providing greater clarification with regards to the cause of any behaviour change encountered.

2.4.1 Habitual behaviours

While it has been shown that social norms are largely effective with regards to behaviour change, the strength of habit should be taken into account. Many common consumptive behaviours such as those which are engaged in in the home or the workplace may be quite repetitive or automatic in nature. Therefore, it is likely that with behaviours such as these, there may be existing habits which have formed over time. Habits are defined by Wood, Labrecque, Lin and Rünger (2014) as learned automatic responses which are activated by consistent cues in the environment and which are resistant to short term goal changes. Klockner and Matthies (2004) discuss the impact of habitual behaviours on the daily lives of individuals and posit that habit is specifically related to the repetition of behaviours facilitated by the same circumstances and activated by exposure to the same situational cues repeatedly. Ouellette and Wood (1998) describe how the repetition or practice of similar

behaviours over time result in an eventual automaticity developing with regards to the behaviour.

Wood and R nger (2016) describe how contextual cues associated with habitual behaviours are likely to inhibit goal pursuit. Verplanken, Walker, Davis and Jurasek (2008) found that where habitual behaviours are concerned, individuals may behave in a manner which does not align with their attitudes. Walker, Thomas and Verplanken (2015) later suggested that this phenomenon would appear to be as a result of the automatic nature of habitual behaviours which causes them to continue, seemingly impenetrable to the attitudes and intentions of the individual. Accordingly, it has been found that habitual behaviours are more easily broken successfully at times where there has been a sufficient change in the environment to disrupt the automatic nature of the behaviour. Therefore, the habitual nature of behaviours targeted through normative interventions must be established as this may inhibit any response to a social norms campaign.

2.4.2 Individual Differences

A further factor which must be taken into account is that of any potential individual difference which may exist which may impact on the effectiveness of a normative intervention. It has been suggested in the literature that some research which examines normative influence may have suffered with measurement issues due to the presence of individual differences being overlooked. Keeling (2000) suggested that when measuring the impact of normative influence, where possible, reasonable care must be taken to ensure that other variables and individual differences are controlled for, particularly those which are likely to have an effect on the outcome behaviour. For example, Olds and Thombs (2001) found that student alcohol consumption was effected by their housing situation with those living in residence halls engaging in greater consumption than those residing off-campus. While it is not possible to control for all potential individual differences in a population

sample, an awareness that there may be other factors at play is important when establishing the cause of any effects.

When considering the effect of descriptive norms on an individual's behaviours, the manner by which the impact of the intervention is measured should be taken into account. Many studies which are aimed at understanding and targeting behaviour explore the attitudes and intentions of the target individuals in order to establish changes in these variables following the provision of a message or exposure to an intervention, for example. However, care must be taken extrapolating findings in this manner as changes in attitudes and intentions do not necessarily correspond with changes in behaviours. Webb and Sheeran (2006) discuss this issue in their meta-analysis on intentions and behaviour change. They found that a large change in intention is likely to only lead to a small-to-medium change in behaviour. In the case of university students, where peer behaviour has been shown to be a powerful source of social influence, Perkins and Berkowitz (1986) found that there was a strong correlation between the attitudes and perceptions of drinking behaviours but that there was in fact a negative correlation between perceptions and self-reported behaviours. This indicates that while attitudes towards drinking frequency have improved, behaviours have not. For this reason, studies which assess an individual's change in attitude or intention to engage in a particular behaviour following a social norms intervention may not be as indicative of intervention effectiveness as studies which examine actual behaviours objectively.

Schwartz (1977) noted that individuals tend to have a moral obligation to engage in prosocial behaviour as a result of moral or personal norms. However, social norms, and their behaviour changing and behaviour influencing mechanisms are themselves highly complex for the individuals in question. Individuals may publicly declare their adherence to the injunctive norm as they believe this is what they should do, while engaging in a different behaviour because they believe that it what everyone else is doing (Wenzel, 2005). This

offers further support for the necessity to employ objective methods of behaviour measurement to establish with confidence the extent to which behaviour has changed.

2.4.2.1 *Norm focus*

Returning to the *Focus Theory of Normative Conduct* as outlined above, it is possible that a number of factors may be present in an environment which can both draw focus towards and distract attention away from a desired norm. These shifts in focus can potentially cause differing behavioural responses for different people, depending on what was focal at the time (Kallgren et al., 2000). Individual differences may determine which additional factors, if any, will be more focal than the targeted norm. However, it can be difficult both to identify and attempt to control for such environmental factors in a typical social context, due to the multitude of potential confounding variables which may become salient in a given setting.

Similarly, with reference to the *Focus Theory of Normative Conduct* (Cialdini et al., 1990), if the norm is not salient or focal, there is likely to be little measurable effect from an empirical perspective, again pointing to the importance of ensuring a strong focus on the norm at the time of the behaviour. Conversely, as the majority of studies relating to social norms are carried out in a social context, with potentially numerous environmental factors present, it is unlikely that the impact of other cues in the environment could be measured or controlled for satisfactorily. It has been suggested by Kallgren and colleagues (2000), that normative focus, and resultantly, normative impact and influence, may also be affected by dispositional factors. They posited that personal attributes may decide the extent to which a social norm will impact a behavioural response, if at all. This can determine whether an individual looks to the environment to guide behaviour, or focuses internally on their personal values to make those choices, in situations where a compatible norm is not readily available. The authors further suggest that this could potentially be assessed through the use of a *Self-Monitoring Scale* (Snyder, 1974) or *Self-Conscious Scale (Revised)* (Scheier & Carver, 1985).

2.4.2.2 *Self-monitoring*

Self-monitors are individuals who alter their behaviour to suit a particular social situation or context. In other words, individuals deemed to be high self-monitors, are more likely to be shaped by their environment; namely other individuals and groups, than they are by their own personality traits and beliefs. Snyder's (1974) *Theory of Self-Monitoring* suggests that individuals use environmental cues to determine socially appropriate behaviour and adjust their own behaviour accordingly. He defined a self-monitoring individual as "*one who, out of a concern for social appropriateness, is particularly sensitive to the expression and self-presentation of others in social situations and uses these cues as guidelines for monitoring his own self-presentation*" (1974, p528).

The level of engagement in self-monitoring behaviour differs from individual to individual with some significantly more concerned with monitoring their behaviour than others. While the above definition relates to high self-monitors, low-self monitors on the other hand, are those individuals whose motivations and behaviours are less related to the behaviour of others, and rather are associated with the individuals own values, beliefs, attitudes and dispositions (Snyder, 1979). According to Snyder (1987) individuals in this category are less concerned with others' opinions and are happy to behave in a manner which is in accordance with their personal values and beliefs. Low self-monitors are therefore less likely to respond to social influence if it is not in line with these personal values.

Snyder (1974) has suggested that there are links between self-monitoring and need for approval. Crowne and Marlowe (1964) posited that individuals requiring need for approval are likely to engage in various self-presentation strategies and are highly astute in terms of responding and behaving in a socially desirable manner. A recent study found that there was no correlation between self-monitoring and intention and behaviour (White, Smith, Terry, Greenslade, & McKimmie, 2009), suggesting again that responses are in line with self-presentation strategies. An interesting suggestion which was made by Snyder (1987) states

that an individual has as many representations of themselves as the number of people they know. In other words, those that engage in very high levels of self-monitoring can alter their behaviour for each different individual or group that they encounter. This may suggest that any behaviour engaged in within a social context may not actually be representative of the true values and personal norms of the individual, and rather behaviours which are conducted in private settings away from the influence of others may be more indicative of the true nature of the individual.

Snyder (1974) identified the need for a measure which could suitably grasp individual differences between self-monitors as well as the extent to which respondents engage in self-monitoring of behaviour. It was important that the measure had the ability to capture individual differences relating to social appropriateness desires, sensitivity to both self-presentation and expression in others as cues to appropriateness in social situations, and the ability to use these social cues to guide one's own expressive behaviour and self-presentation. The Self-Monitoring Scale was thus developed and includes self-report statements such as "When I am uncertain how to act in social situations, I look to the behaviour of others for cues" and "Even if I am not enjoying myself, I pretend to be having a good time". The measure indicates levels of self-monitoring rated from high to low, and could be a useful tool in the measurement of social influence. As suggested by Kallgren and colleagues (2000), this may be a useful tool to determine the extent to which individuals are influenced by internal or external processes.

2.4.2.3 Self-consciousness

Self-consciousness shares some similarities with self-monitoring, in that it describes the extent to which individuals are guided by their internal states or how they are perceived by others. Scheier and Carver (1975) define self-consciousness as consisting of two separate constructs, namely; public self-consciousness and private self-consciousness. Public self-consciousness relates to the overt behaviours of an individual and the focus on those aspects

which relate to public display and which may be evaluated by public opinion. Private self-consciousness relates to the covert aspects of an individual such as private attitudes, beliefs and values. These aspects are generally less available to the judgement and scrutiny of others (Scheier & Carver, 1985).

A Self-Conscious Scale (Fenigstein, Scheier & Buss, 1975) was originally developed to measure individual differences in public and private self-consciousness, while also measuring a third construct of social anxiety. However the original scale was found to be vague in its wording and was thus updated in 1985 (Scheier & Carver). The current scale again measures the three constructs of public self-consciousness, private self-consciousness and social anxiety. Social anxiety in this sense is linked to public-self-consciousness and the evaluation of an individuals' overt behaviours in a social setting by others. This setting can create anxiety by means of questioning their ability to effectively manage their self-presentation in a given context to reflect social norms (Schlenker & Leary, 1982).

Tunnel (1984) has suggested that individuals reported to have high levels of publicly self-conscious behaviour are more likely to have larger discrepancies between their public selves and behaviour and their private selves and behaviour. Understanding the extent by which individuals are driven by public or private self-consciousness may be useful in terms of understanding how concerned individuals are about self-presentation in private contexts in comparison to public and social situations. It is therefore likely, in line with Kallgren and colleagues (2000) suggestion that this construct is important with regards to the likelihood that an individual will be influenced by social norms.

2.4.2.4 Self-categorization

A potential barrier to the effectiveness of normative social influence is the perception of group membership and group identity. Social norms are effective as a behaviour change tool as they serve to highlight what the common behaviour is in a given context which often results in individuals whose behaviour deviates from this norm, to amend their behaviour

accordingly. It is thought that this change in behaviour might come about in order to retain group membership and to avoid any potential group sanctions. If the target individual does not categorize themselves as being part of the referent group, it is unlikely that any normative style interventions will have a persuasive impact. The threat of social sanction is unlikely to be of any importance to individuals who do not associate themselves as being a member of the group. One of the criteria for group membership has been noted as the existence of shared norms and values, which allow for regulation of behaviours and attitudes within the group (Turner, 1982). This highlights the importance of an individual's self-categorisation as being part of a group in order for the group norm to be influential and motivate behaviour.

According to early research by Lewis (1971), deviations from desired behaviour, or public transgressions are likely to result in feelings of shame, and are therefore likely to be avoided, thus encouraging the individual to behave in line with the group norm. For these public transgressions, Lewis stated that individuals are likely to conceptualise this in terms of the 'self' in that they focus on how they are being evaluated by the group (e.g. *My behaviour was wrong*). Private transgressions, on the other hand, tend to elicit feelings of guilt, and rather than associating this with their self-perception, instead focus on the behaviour itself and how the behaviour, as opposed to the individual, has affected others (*My behaviour was wrong*). This is known as the self-behaviour distinction (Lewis, 1971). This potential distinction between the internal responses to private or public normative influence therefore suggests that in the case of normative interventions, these may be responded to differently depending on whether the context is public or private. Furthermore, in line with the issue of group membership, if a target behaviour is engaged in in a private setting, it is unlikely that the threat of a social sanction exists when the behaviour is not visible to the referent group.

2.5 General barriers to behaviour change

2.5.1 Incentives

Attempting to encourage environmentally impactful behaviour change in any organisation can be seen as a challenge due to the general lack of any direct incentives for staff to engage in pro-environmental behaviours (Carrico & Riemer, 2011). Similarly, in situations where the target individual will neither benefit nor suffer as a result of a change in behaviour, it may also be difficult to incentivise and motivate behaviour change. While it would appear that the most logical solution to encourage pro-environmental behaviour change would be the provision of rewards or incentives, such as prizes for good behaviour or staff benefits, Gneezy and Rustichini (2000) found that extrinsic motivators such as rewards or prizes tend to oppose intrinsic behaviour, and this can also lead to problems when the reward is no longer available. It is therefore better to find an alternative which will motivate behaviour change without evoking extrinsic values and motivations. Feder and colleagues (2012) found that when a rewards system was employed by a university in the laboratory for energy conserving behaviours, after the rewards were removed, the behaviours reverted to pre-reward levels as there is no longer a personal benefit to engaging in the behaviour (Geller, 2002).

Further, in the case where there is no penalty associated with increasing engagement in environmentally harmful behaviour, this can serve as a further barrier to behaviour change. For example, in situations where there is a flat charge irrespective of levels of use as in the case of utility bills in campus residences, or flat charges. Mailloux (2011) found that in the case of on-campus showering behaviour, students admitted that they would be 'showering lavishly' until graduation as costs remained static irrespective of the level of water use. A similar finding was noted in the case of fixed charges for water use, in that this provides no incentive to conserve (Baker, 2009). Similar outcomes were found in the case of electricity use (Bekker et al., 2010; Petersen, Shunturov, Janda, Platt, & Weinberger, 2007).

Therefore, addressing the aims of the current thesis presents a challenge, in that beyond potential positive environmental outcomes, there is little by way of personal benefit to engage in such behaviours. The use of a social norms intervention must therefore possess sufficient power to encourage behaviour change in the absence of any incentive. While this may present a more difficult task, the application of a social norms intervention in such settings allows for a more accurate measurement of the impact of the norm without the potentially confounding factor of personal incentives which may cause undue influence with regards to any behavioural response measured.

2.5.2 Lack of environmental concern

As it is unlikely that all campus users will be willing to actively engage in pro-environmental activities, interventions which will be effective regardless of attitudes to the environment are imperative to overcome the issue. Should a behaviour change intervention specifically involve an environmentally framed message, this may inadvertently exclude individuals who do not actively engage in environmental behaviours or possess environmental concern, as such messages are unlikely to appeal to them. Therefore, employing a strategy which does not rely on target individuals' engagement with environmental messages is an important component which must be considered when developing a suitable intervention. To that end utilising a social norms intervention which simply highlights the discrepancy between the behaviour of the target individuals and their reference group may overcome this issue. Goldstein and colleagues (2008) demonstrated the effectiveness of this whereby individuals showed greater changes in behaviour in response to the norm than to a message which appealed to their environmental values.

A review of psychological theory on behaviour change has shown that social norms are an effective method of behaviour change which could be particularly relevant and useful in a campus setting, and is a low-cost alternative strategy to improve pro-environmental behaviour change (Grisvickius et al., 2008). Using a social norms intervention removes the

need to target individual values and attitudes which can be an exhaustive process. Instead, the use of social norms appeals to individuals' sense that they may be different from their peers, thus encouraging behaviour to fall in line with the descriptive group norm. By focusing on norms rather than values and attitudes, this allows for a single behaviour change message to potentially influence the behaviour of a vast number of people.

2.5.3 Psychological barriers to sustainable behaviour

Gifford (2011) discusses the psychological barriers which may be present with regard to the prevention to engagement in sustainable behaviours. While it is difficult to account for all potential barriers which may hinder environmentally friendly behaviours, it is important nonetheless to have an awareness of the wide reaching and complex factors which may exist. Gifford identified 29 key obstacles which may impede environmentally beneficial behaviours which he has reduced to seven categories. While the current thesis will not have the scope to address each of these issues, it is worthwhile to note that there may be some element of these barriers at play when attempting to change behaviour.

Gifford (2011) defines limited cognition as a key issue, which describes the extent to which humans are irrational and for many thinking has largely not evolved sufficiently to possess suitable levels of global concern with regard to climate change. Next he discusses ideologies, which include the strength which belief systems may have over behaviour, including from a religious perspective as well as the perception that technology will prevail. The third barrier addressed is that of social comparison, which has been described extensively previously, however, he makes note of the issue of perceived inequality, whereby individuals may not wish to engage in sustainable behaviour when they believe that others do not. Sunk costs, such as financial commitment and conflicting goals may also serve as a barrier with regards to particular behaviours. Discredence was also identified as a behaviour change barrier, and describes the issue whereby the individual who is trying to promote change, is not trusted by the target audience which inhibits the uptake of the

behaviour. Additionally, individuals may perceive various risks associated with sustainable behaviours, such as cost, functionality or social risk. Finally, individuals engaged in minimal sustainable behaviours may perceive they are making an impact, and thus making no further effort, or using this to justify engagement in other environmentally damaging behaviour.

2.6 Criticisms

While it was stated in 1991 by Cialdini and colleagues that at that point there was little in terms of consensus in the field with regard to the value and power of social norms as a predictor of or an explanation for human behaviour, the increasing evidence to date would appear to suggest that their utility is now difficult to dispute. Earlier studies such as Krebs and Miller (1985), and Darley and Latané (1970) questioned the validity of social norms. However, this may have been as a result of the then lacking theoretical refinements in terms of the definition and distinction between injunctive and descriptive norms, as well as the discovery of the importance of normative focus in order for normative influence to occur (Cialdini et al., 1991).

However, while social norms have undoubtedly been shown to be effective with regards to their ability to change behaviours, there are some methodological issues which must also be addressed. Many of the early experimental studies evaluating the effectiveness of social norms were conducted in manipulated environments. For example, studies on littering (Cialdini et al., 1990; Keizer, Lindenberg, & Steg, 2008) examined the impact of social norms in environments which were constructed by the researcher. While the normative intervention was found to be effective, it is unclear as to whether the effect would be generalizable to more naturalistic settings. Indeed, further studies demonstrated the utility of social norms in real world settings such as through the intervention targeting wood theft in a natural park (Cialdini et al., 2006). However, this type of setting is not representative

of those which are likely to be encountered frequently, and thus unlikely to have a significant environmental impact.

Accordingly, social norms interventions should be applied in real world settings which are widely representative of contexts which individuals frequent on a regular basis. Behaviours which are shown to be environmentally impactful and which are engaged in on a large scale should also be targeted, as this will ensure that the application of a normative intervention is likely to have a greater impact and higher levels of generalisability with regards to future roll outs.

Furthermore, a multitude of social norms research has failed to explore the long term impact of normative influence and whether social norms have the power to change repetitive or habitual behaviours over time in a sustained manner. While the research on social norms has provided a wealth of findings and knowledge with regard to the processes and mechanisms relating to normative influence, it is not commonplace to evaluate the impact of the intervention through the use of a long-term follow up. Rather, many normative intervention studies were conducted over a short period of time, measuring the change in behaviour within a short time frame following the implementation of the intervention. Should the effectiveness of an intervention be evaluated immediately following the implementation, this may result in under- or over-estimating the realistic impact of the norm. However, there are some exceptions available where a long term approach was employed, (Foss, Deikkman, Bartley, & Goodman, 2004, for example). Therefore, it would appear that there is a gap in the literature with regard to the evaluation of the effectiveness of social norms from a long term perspective.

2.7 Addressing the current issue

While the issue of climate change and environmental protection is at the pinnacle of world problems, simple individual actions such as waste separation and energy conservation are becoming less frequent (Ruckert-John, Bormann, & John, 2013). This illustrates that despite

widespread knowledge and information as well as campaigns and personal incentives such as reduced energy and waste bills, individuals are no longer motivated to behave in a way that is pro-environmental (Hamann, Reese, Seewald, & Loeschinger, 2015). Despite extensive media coverage and a greater global awareness as well as ease of access to information relating to the environment and harmful human behaviours, it is imperative that other directions are taken in the fight for the protection of the environment.

It has been suggested that social norms are a significantly underutilised resource in the attempts to address climate change (Griskevicius et al., 2008). It is important to explore this possibility, particularly when the findings of previous studies have been so promising in a variety of domains and presents social influence as a robust mechanism which can be applied for both the prediction and explanation of human behaviour (Aarts & Dijksterhuis, 2003; Schultz et al., 2007). The application of social norms as a method to change behaviour in a campus setting has been successful on many occasions in the past. Berkowitz (2003) reported that a number of institutions have found a reduction in harmful or high-risk drinking by approximately twenty percent as a result of an intensive social norms approach campaign.

However, despite the extensive literature available which provides clear support for the use of social norms, it must be recognised that social norms campaigns are not without issue, and are certainly not guaranteed to elicit a desired behaviour, despite being carried out without fault. It has been shown by several authors that social norms interventions can be unsuccessful. Studies by both Real and Rimal (2001) and Baer and Carney (1993) found that correcting individuals perceptions on alcohol consumption norms did not influence alcohol consumption. Furthermore, Weschler and colleagues (2003) also found that a social norms marketing campaign aimed at reducing drinking habits in fact resulted in an increase in alcohol consumption in some cases.

Taking this into consideration, it would appear that social norms campaigns would be a logical first step in the attempt to improve pro-environmental behaviour in various settings on-campus. As it is a low-cost strategy, which appears to have been underused in this domain (Griskevicius et al, 2008), it could have potential to make significant gains for little investment. The extensive literature to date has provided sufficient guidance to execute a study which takes into consideration the potential barriers and issues likely to be encountered, as well as those aspects of social norms campaigns which have been shown to be effective. Putting focus on private behaviours, self-monitoring and self-consciousness, future studies may also add some novel and important findings to the literature on social norms.

2.8 Conclusion

In conclusion, the current chapter aimed to present a comprehensive account of social norms theory, from which to provide a suitable background for the subsequent chapters in this thesis. Having extensively explored the literature on social norms and normative influence, research on the efficacy of this approach with regards to environmental behaviors demonstrated the success which has been shown in this field. It has also shown the issues which may arise and factors which should be considered with regard to the efficacy of normative influence. Furthermore, while social norms have been shown to be highly effective, some criticisms of the literature to date have been presented. It is anticipated that the teachings of this literature and previous research will serve to suitably inform the development of social norms interventions which may result in environmentally significant behaviour change.

Therefore, the current thesis aims to address several gaps in the literature through both exploratory and applied research. Firstly, there is a dearth of literature in the field of social norms which assesses the long term impact of social norms interventions. It is therefore important to conduct research which can be monitored and followed up over a longer period

of time, to determine at what point the effect of normative influence begins to wane. Chapter 3 will attempt to address this issue through the use of a long term normative intervention study, targeting energy consumption in the workplace. The study will collect data for eight months following the implementation of a descriptive normative intervention in a chemistry lab, in order to gather a better understanding of the longevity of a normative intervention.

The thesis also aims to add to the understanding of normative misperceptions, and will explore whether the privacy of a behaviour relates to the extent that the behaviour is misperceived. This will help to identify types of behaviours which are susceptible to misperceptions and which may benefit from a normative intervention. To date, the normative misperception literature has mainly focused on individual behaviours, predominantly those which could be deemed harmful on a personal level. However, research has not yet addressed what types of behaviours people might be more likely to have inaccurate perceptions about, and Chapter 4 aims to begin to address this gap by exploring if privacy has an impact on misperceptions.

Taking this a step further, Chapter 4 and Chapter 5 will attempt to determine if social influence can occur when the target behaviour is, in fact, private. The impact of privacy of behaviours on normative influence has not yet been addressed explicitly in previous literature. Social norms have been described as ‘observable behaviours’ (Miller & Prentice, 1996), brought about by another individual or group (Breckler et al., 2005), and are used for vicarious reinforcement, whereby consequences and outcomes of behaviours in specific contexts are observed in an attempt to learn socially acceptable behaviours (Bandura et al, 1963). Accordingly, these definitions appear to suggest that social norms are effective when the behaviour is visible and known to others, which poses a limitation for behaviours which occur in private. The thesis will therefore explore if this is the case, and whether private behaviours are susceptible to normative influence.

Chapter 3 and Chapter 5 will also explore the benefit of using a social norms intervention in the workplace, or other situations where there is an absence of rewards or incentives for behaviour change. According to Baker (2009), contexts such as university accommodation are likely to struggle with conservation behaviours as a result of a fixed cost which is not dependent on amount of usage or energy or water, for example. In the same vein, workplaces rarely have the means to promote conservation behaviour through rewards systems and therefore can struggle to elicit change. The thesis therefore aims to explore the possibility of using social norms interventions to target behaviours for which behaviour change incentives are not available. This will add to the literature on social norms as it will demonstrate their effectiveness on their own merit, and without the necessity of framing normative messages in an environmental manner, and rather will simply present descriptive normative information.

The thesis will also draw on the potential impact of habitual behaviours on social norms and normative influence. To date, the literature on norms has not extensively examined the potential conflict between habits and norms. Again, the contexts of the workplace and the home will be used in the empirical studies in Chapter 3 and Chapter 5 to explore this. As many behaviours which occur in the home, particularly hygiene behaviours, and those in the workplace could be considered habitual, it is important to establish if social norms have the ability to penetrate habitual actions or if habit strength is superior. This will also help to add a further dimension to the knowledge on what types of behaviours may be more suitable for and responsive to normative interventions.

Chapter 3: Evaluating the impact of a descriptive norms intervention targeting energy consumption in the laboratory

3.1 Abstract

Workplace behaviour change is typically difficult to target, particularly as there is little personal incentive to change, and the automaticity of workplace activities can facilitate habitual behaviour. Social norms have been shown to be an effective behaviour change mechanism in a variety of contexts. Study 1 implemented a descriptive norms intervention to determine if workplace behaviour change could occur in the absence of incentives or a contextual change, with a specific focus on the behaviour of closing fume hoods when they are not in use. The intervention consisted of blank rulers for baseline data collection to measure sash opening height, which was replaced with a ruler with normative information about average sash height at other universities for the intervention phase. It was found that there was a lasting, substantial reduction in fume hood energy use following the intervention. However, there also appeared to be a reactance response following the cessation of data collection which may have been attributed to the presence of the researcher. Study 2 replicated Study 1, however omitted observational data collection by the researcher in order to determine any effect, and instead relied on objective energy data only. It was found that there was no reactance response and that behaviour change occurred at the baseline time point with blank rulers, with no change following the addition of the normative information. Possible interpretations of this effect are discussed.

3.2 Introduction

Recent research by Chung and Rhee (2014) found that in existing university buildings there is a potential for significant energy reduction. According to Hopkinson, James, Lenegan, McGrath and Tait (2011), in a typical UK university campus, science laboratories are responsible for 3-4 times more energy consumption per square foot than office spaces, suggesting that these are suitable buildings to target for an energy reduction intervention. It could be assumed that at least part of the cause of this elevated energy consumption in

science laboratories is as a result of the use of fume hoods, due to the large amount of energy which they require to run effectively. Fume hoods are used in chemistry laboratories to reduce lab users' exposure to harmful chemicals (Wooliams, Lloyd, & Spengler, 2005). These ventilation devices account for a vast amount of energy consumption on campus with one fume cupboard expending as much energy as approximately four standard homes per year (Mills & Sartor, 2005).

The extent of unnecessary energy consumption is intrinsically linked with human behaviour, as lab users are responsible for closing the window or 'sash' of the fume hood, which reduces the strength of the air flow, when they are not in use. In many universities, these systems run twenty-four hours per day as a safety measure, and therefore it is imperative that they are being operated in an efficient and sustainable manner. As universities with chemistry departments might typically have hundreds of fume hoods on an average sized campus, it is important to ensure that the majority of fume hood energy consumption is limited to when the fume hoods are actually in use. Because of the excessive amounts of energy used in these buildings and the associated costs, from both a financial and environmental perspective, it is imperative that lab users engage in conscientious fume hood behaviour. This would simply involve pulling down the fume hood sash when it is not being used, in a similar fashion to how a sash window is closed. Despite information, awareness and signage in the laboratory reminding users to close the sash, it is apparent that lab users often leave their fume hoods open when they are not in use, resulting in unnecessary energy wastage. The misuse of fume hoods is therefore a critical issue to understand and address in order to limit both negative financial and environmental outcomes associated with this behaviour.

The following chapter focuses on the efficacy of a social norms intervention for the reduction of energy consumption in the workplace, with a specific focus on fume hood use in chemistry laboratories. The chapter will provide an overview of the relevant current

information pertaining to non-domestic energy use and will place emphasis on the necessity for behaviour change in terms of fume hood closure in university chemistry laboratories. However, achieving workplace behaviour change can be an arduous process, particularly because of the lack of behaviour change incentives, situational barriers, resistance to change, as well as habitual behaviours, which will be discussed below. Due to the nature of the target behaviour, which has important potential health and safety implications, careful consideration must be given before the implementation of any behaviour change strategy. The key requirements in this regard are outlined below, namely, workplace disruption, long-term behaviour change and responsibility and feasibility. Guided by these issues and considerations, the use of a social norms strategy is discussed with regards to its suitability in terms of achieving the desired behaviour change of closing fume hoods when not in use. Based on the available literature, it is apparent that a social norms intervention may be an appropriate strategy which will be applied in this case. The benefits of using a social norms intervention will be presented, along with evidence from previous research showing the efficacy of social norms with respect to pro-environmental behaviour change, which will then lead to the aims and hypotheses for the current study.

3.2.1 Non-Domestic Energy Use

Recent years have seen a surge in energy saving initiatives in an attempt to curb the harmful effects of the continually increasing carbon footprint. While on an individual or domestic level, many improvements have occurred through the emergence of efficient appliances, home refurbishing incentives, awareness campaigns and behaviour change strategies, there appears to have been less focus on non-domestic energy use. While advances in technology have resulted in some improvements, emissions from non-domestic buildings have shown little reduction over the last twenty years (Carbon Trust, 2013). On a European level, non-domestic buildings account for approximately 14% of energy consumption in the EU (Ahern & Norton, 2015). Most recent data indicate that these buildings account for approximately 19% of carbon produced in the UK, and while this is still somewhat lower than domestic

carbon production, which accounts for approximately 27%, it is still important to address this sector due to the sizable contribution it makes to the annual global carbon footprint. Azar and Menassa (2012) have highlighted that some of the recent initiatives aimed at reducing non-domestic energy consumption have shown discrepancies in terms of predicted and actual energy reduction. They posit that this discrepancy may have arisen as a result of overlooking the human behaviour element which they found is an important factor which should be considered when attempting to reduce non-domestic energy consumption.

Attempting to change behaviour in the workplace can be a challenging task, particularly as there is generally little or no personal benefit to behaviour change for the individuals involved. Research has shown that financial incentives can be an effective incentive to encourage pro-environmental behaviour change in the workplace (Young et al., 2015), and this type of strategy has also been suggested as a possible solution to encourage sustainable energy consumption in the laboratory (Kaplowitz et al., 2012). However, due to various factors, this is not a feasible option. The university setting and the diverse population of lab users which includes students, post-graduate researchers and staff means this is a difficult group to target in terms of a blanket incentive. Further, financial incentives in such a large organisation are likely to be costly, exhaustive and unsustainable in terms of maintenance over a period of months or years. The provision of rewards may also lead to an eventual decline in motivation to engage in the behaviour (Deci & Ryan, 1987) as this may result in the task being viewed as one which is unattractive or undesirable, thus requiring a reward for its completion (Deci, 1971). Similarly, penalties such as fines are also unsuitable for this group as it could be suggested that this might compromise the health and safety of the lab users if such a strategy resulted in lab users closing the fume hoods excessively and when it is not safe to do so, thus exposing themselves to harmful chemicals. Further, penalties have been identified as the practice considered least effective by organisations in terms of

methods to encourage pro-environmental behaviour in employees (Zibarras & Ballinger, 2011).

Currently, many universities have adopted the 'Shut the Sash' campaign as the main behaviour change strategy in relation to fume hood energy saving. The campaign, which consists of inter-lab energy saving competitions, originally beginning in 2005 in Harvard (Emig, 2006), appears to show some success through the strategy of offering a small regular reward to the lab which performs the best on a monthly basis. The competition operates with the use of email notifications, performance visibility and reminder stickers on the fume hoods. However, there is a possibility that this might only be likely to incentivise those that are already performing well. For those labs that perform consistently badly, they may not make any effort to change, as winning the competition may be perceived as being unrealistic or unattainable. This issue can occur as a result of goal disengagement, whereby the target behaviour is abandoned, and the effort is instead refocussed elsewhere (Wrosch, Scheier, Miller, Schultz, & Carver, 2003). Similarly, according to Siero and colleagues (1996), the use of normative information about referent others can serve to have a negative impact on behaviour. When individuals attempt to maintain a positive self-identity, yet still fail in terms of performing in line with the referent group, in this case lab peers, this may serve to impact motivation and ultimately decrease performance. While it could be suggested that the provision of such behaviour change incentives would be an appropriate strategy, maintenance of such reward systems can be costly and resource intensive in terms of consistently monitoring behaviours. Further, while rewards are more effective than penalties for behaviour change (Gellar, 2002), rewards are only effective in the short term and once the reward is removed, this effect is also removed (Steg & Vlek, 2009).

3.2.2 Current literature

Despite the prevalence of fume hood use, and significantly, its associated energy wastage, following an exhaustive search of the literature there appears to be a dearth of research in

terms of empirical studies relating to the implementation of interventions aimed at targeting this behaviour. However, two relevant empirical studies related specifically to fume hood behaviour change exist in the currently available literature which are of particular relevance. Feder, Robinson and Wakefield (2012) examined the efficacy of an information and awareness campaign using stickers placed on the fume hood sash to encourage fume hood closure, coupled with a competition to encourage sustainable fume hood behaviour over several months. It was found that there was an immediate positive behaviour change outcome but that this effect had largely worn off by the final data collection period eight months following the initial implementation of the campaign. Further, this study did not use actual energy data, but rather relied on observational data, whereby behaviour change was measured through unannounced inspections of fume hood sash heights. This method of data collection may have issues in terms of accuracy and could have benefitted from a more objective means of data collection.

Kaplowitz, Thorp, Coleman and Yeboah (2012) also presented an empirical study which explored the factors relating to laboratory energy saving, including fume hood energy use, with a focus on awareness, attitudes, and barriers. This study ultimately found that there was a lack of available options for chemistry lab energy conservation, with both operational and economical barriers present. It was also found that there was an apparent attitude amongst the lab users involved in the study which appears to suggest that energy conservation strategies might compromise their work. The findings of these two pieces of literature comprise much of the available data associated with fume food conservation behaviour research and are therefore important in terms of informing any future research relating to fume hood related energy reduction and should therefore be carefully considered.

3.2.3 Barriers to behaviour change

As highlighted by Kaplowitz and colleagues (2012) there are various potential barriers which are present which limit the ability of meaningful behaviour change in relation to fume

hood use. Therefore, prior to the implementation of any behaviour change strategies, possible barriers to change must be considered in order to determine how these might impact the effectiveness of any implemented strategy (Steg & Vlek, 2009). Kollmuss and Agyeman (2002) state that the cause of discrepancies between environmental attitudes and awareness and actual behaviours is due to the existence of barriers to behaviour change. In Steg and Vlek's (2009) framework for pro-environmental behaviour change, they suggest that it is necessary to attempt to remove barriers to change, in order to assist in the smooth transition from the current to the desirable behaviour. However, the barriers which they refer to are arguably more tangible, contextual barriers such as suitable recycling facilities and infrastructure, for example.

According to Blake (1999), there are three key barriers to behaviour change, namely individuality, responsibility and practicality, which lie between an individual's environmental concern and their potential pro-environmental behaviour. Individuality, which relates to an individual's attitude, which could potentially represent either high or low levels of environmental concern, is likely to be difficult to target and change in the workplace setting, and even in the case of successfully changing attitudes, this may still not lead to desired behaviour change, in line with the value action gap (Blake, 1999). However, responsibility and practicality may be more relevant barriers to consider in this case. The responsibility element of Blake's model relates to the individuals' perception that they can or cannot change the situation, or indeed that it is not their responsibility to take action (Owens, 2000). In the case of chemistry laboratories, a single individual may feel that if they close their fume hood regularly but that others do not, then it is a pointless exercise, and that they alone cannot take responsibility for the entire issue. Similarly, the practicality of the behaviour must be considered, which relates to the constraints associated with the desired behaviour such as time limitations or a lack of information (Blake, 1999). In the case of the laboratories and lab users, this issue could be simplified to perceived

convenience of the behaviour of shutting the fume hoods. In the case of the latter, despite any pre-existing environmental concern or motivations, internal barriers such as personal comfort may serve to override any motivation to engage in pro-environmental behaviour (Kollmuss & Agyeman, 2002). This is evident through Feder and colleagues (2012) study, whereby approximately 42% of individuals cited inconvenience as the reason for not closing their fume hood when not in use.

3.2.3.1 Situational factors

While it could also be suggested that a lack of environmental awareness or knowledge may explain reduced levels of engagement in environmentally protective behaviours such as, in this case, closing fume hoods, Fliegenschnee and Schelakovsky (1998, cited in Kollmuss & Agyeman, 2002) found that the majority of pro-environmental actions are engaged in as a result of internal or situational factors, as opposed to as a result of environmental awareness. This is further supported by earlier research by Schultz, Oskamp and Mainieri (1995) who found that situational variables were strongly related to increased recycling behaviour. This suggests that the practicality of the behaviour as mentioned above plays a significant role in the engagement in certain behaviours. This is in line with Steg and Vlek's (2009) indication that pro-environmental behaviour is steered, at least in part, by comfort, effort and behavioural opportunities. To that end, however, there is little by way of situational barriers in relation to fume hood closure which could be removed in order to further increase the perceived practicality of the behaviour, other than perhaps highlighting the ease with which this behaviour can be engaged in, and identifying others that have been able to engage in this behaviour despite these perceived constraints.

3.2.3.2 Resistance to change

An additional factor which might be considered as a barrier to workplace behaviour change is the potential resistance to change amongst employees, which in the case of the current study are chemistry lab users. According to Brehm and Brehm (1981) there is now a greater

desire for employee autonomy in the workplace, which may be defined as being given the freedom and responsibility to make some of the decisions. Autonomy in the workplace has been linked to greater creativity and productivity (Sia & Appu, 2015) highlighting the importance of not stifling this creativity with the introduction of rigid rules and practices which are aimed at changing behaviour. Greater workplace freedom and autonomy has also been viewed as being beneficial to the employee in terms of wellbeing (Thompson & Prottas, 2006). Any threat to this freedom, such as through the introduction of firm rules and sanctions, may have unfavourable consequences (Brehm & Brehm, 1981). Psychological reactance is one such negative consequence which may arise when an individual's behavioural freedom is compromised. Psychological reactance has traditionally been described as a "motivational state directed towards the reestablishment of (a) threatened or eliminated freedom" (Brehm, 1966, p15). Nesterkin (2013) found that attempts by the organisation to implement change in the workplace threatens employees' freedom and ultimately leads to reactance behaviours in order to retain autonomy. Perceived situational constraints on workplace autonomy can inadvertently lead to workplace deviance (Lawrence & Robinson, 2007). It has been suggested that such deviance may arise as a result of a perceived discrepancy between an ideal state and their current state (Robinson & Bennett, 1997) and this change in state would be viewed as a provocation in the form of reactance. Conversely, according to Dickenson and Villeval (2008), monitoring workplace behaviours can result in a positive response from employees by increasing their effort in the workplace.

3.2.3.3 Habits

While developing a strategy which can encourage behaviour change in terms of fume hood sash closure is of foremost importance, a further aim would be to develop a behaviour change mechanism which could potentially result in the formation of new habits, which could add a more permanent behaviour change outcome. Habits can be defined as behaviour patterns which occur in contexts where the behaviour has previously repeatedly occurred

and are associated with a level of automaticity in terms of their enactment (Verplanken & Aarts, 1999). The formation of new sash closing habits could reduce the necessity for behaviour change incentives and maintenance of behaviour change interventions. Habit formation in the workplace may be difficult to achieve due to the potential automaticity of many work-related behaviours and the likelihood that other habits may already be present. Holland and colleagues (2006) found that habit formation in the workplace was possible. With the use of implementation intentions and conscious planning, the old habitual behaviour of not recycling paper and plastic in the workplace was replaced with the new habit of recycling, resulting in a significant reduction in recyclables being put in to the general waste bin. However, research by Lally and colleagues (2010) has shown that habit formation can be a complex activity, and according to their findings, can take anywhere between 18 and 254 days to take effect, and this should be taken into consideration.

To test the effectiveness of an intervention aimed at establishing new habits in order to ensure long term behaviour change and to determine if a new habit has truly been formed, a long-term approach must be taken. This will indicate the persistence of behaviour change and ultimately demonstrate the ability of any intervention aimed at forming new habits. Further, Lally and Gardner (2013) suggest that self-monitoring of behaviour can promote awareness of cues and aid in the understanding of habits. The self-monitoring of behaviour is therefore a key factor to consider, as by engaging in self-monitoring, individuals will check their non-verbal behaviour to ensure that it is in line with their desired self-presentation (Snyder, 1974). Individuals who engage in high self-monitoring and regulation are more likely to be responsive to cues in the environment which target their behaviour. Similarly, however, low self-monitors are likely to be less responsive to any attempts at behaviour change if they are not in line with their existing attitudes, ultimately driven by their internal states as opposed to their desire for situational appropriateness, as is the case with high self-monitors.

3.2.4 Key requirements of behaviour change interventions

Prior to the implementation of a behaviour change intervention, the desired outcomes and operationalisation of the strategy must be considered. The current study, which will target the behaviour of fume hood closure in the Chemistry labs in the University of Bath, must take into account the requirements as well as some boundary conditions of the intervention. These include avoiding disruption of the lab users, the necessity of a long-term behaviour change solution, and the importance of highlighting feasibility and responsibility, each of which will be outlined below.

3.2.4.1 Disruption for lab users

When developing an intervention to be applied in the lab, the aforementioned barriers and previous limitations must be considered. It is therefore crucial to ensure that any intervention must not compromise nor interfere with the work of the lab users (Kaplowitz et al., 2012). In order to achieve this, an intervention which is subtle yet also explicit, should therefore be implemented. Due to the nature of the work carried out by lab users in the chemistry department, health and safety must be a priority and therefore any strategy which is employed must not interfere with the workings of the fume hood, nor cause any obstruction. Therefore, the intervention should be visible to lab users, but not intrusive.

3.2.4.2 Long-term behaviour change

Additionally, the intervention should have the potential to have a lasting effect. While Feder and colleagues (2012) found their intervention to be relatively successful in the short term, this effect had almost entirely returned to baseline levels by eight months following the intervention. An intervention which is simple to implement, requires little maintenance and has the potential to be long lasting is therefore the most appropriate and desirable in terms of a lab-based behaviour change campaign. Therefore, the effectiveness of any intervention which is implemented should not only be tested in the short-term, but should have continuous monitoring over a longer period of time in order to determine at what point the effectiveness, if any, starts to fade and eventually disappear.

3.2.4.3 Responsibility and feasibility

Referring to Blake's (1999) suggested barriers to workplace behaviour change, he highlights the issue of responsibility, whereby individuals may not perceive their ability to change the behaviour, or may think that individually they may not be able to make a difference. Therefore, an intervention which relates to the larger group and perhaps less focuses on the individual may be suitable to overcome this barrier. This suggests that any attempt to change behaviour in the workplace should illustrate that this is achievable and not a behaviour which is difficult to engage in. Similar to this, practicality is also noted as a barrier to behaviour change which relates to the constraints or limitations of the behaviour. This can be achieved by demonstrating that the behaviour has been successfully engaged in previously by others.

Addressing workplace behaviour change is therefore a potentially complicated task with many factors, each of which must be considered carefully. As a result, it is necessary to employ suitable workplace interventions which have the scope to achieve the desired behaviour change while also having the ability to circumvent the issues which are outlined above. While it would appear to be a complex task to employ effective interventions which could suitably address each of the above issues, there may be a singular solution to these issues, through the use of a social norms intervention. Social norms may have the ability to address each of the outlined issues, while also providing a robust behaviour change strategy.

3.2.5 Social norms

The literature review in Chapter 2 describes the manner by which social norms function to achieve behaviour change. As previously stated, social norms are refined into two categories, namely injunctive and descriptive norms. In the context of fume hoods, for example, an injunctive norm could focus on the fact that fume hoods should be closed when not in use because it is bad for the environment or costly to the university. Conversely, the descriptive norm could relate to the extent to which other lab users' close their fume hoods

when not in use. Injunctive norms influence behaviour by means of highlighting what the expected behaviour is, which encourages the individual to behave in accordance with this in order to avoid social sanctions. Descriptive norms, however, influence behaviour by means of illustrating to the individual what is typical behaviour in the specific situation, which may thus encourage the individual to behave in a similar manner. The present research will focus on descriptive norms, which would appear to be an appropriate method of behaviour change, based on success shown in previous student as described in Chapter 2.

3.2.5.1 Focus theory

Previous research has found that by highlighting the prevalence of the undesirable behaviour, this can serve to inadvertently result in an increase in the behaviour which was intended to be reduced. This ‘boomerang effect’ was found when attempting to reduce the incidences of theft of natural artefacts in a public park (Cialdini et al., 2006). The use of a social norms intervention should therefore draw the target individuals to the desired behaviour of closing the fume hoods when they are not in use by highlighting that this is what relevant referent groups do. According to the theory, it would be potentially risky to highlight the existing behaviour, or descriptive norm, as this may encourage individuals to continue to engage in or increase the level of engagement in the undesirable behaviour. Indeed, Kallgren and colleagues (2000) found that normative influence was only effective when the desired norm was focal and salient. In line with the focus theory, Lally and Gardner (2013) state that certain cues can inhibit or support habits, therefore, providing cues which will encourage the habit of closing the fume hood, without drawing attention to the extent of the problem will be more desirable.

3.2.6 The current study

The current study involves the development and implementation of a simple intervention which, through the use of normative information, aimed to provide a subtle but effective

behaviour change mechanism. Taking fume hood sash height and fume hood energy consumption as the dependent variables, a social norms intervention consisting of a ruler sticker will be used in order to attempt to encourage fume hood closing behaviour. Following a baseline data collection period in order to establish baseline sash height and energy consumption, a ruler sticker which displays the normative information of average sash heights from other universities will be placed in a prominent and visible position in the cheek of the fume hood. This will ensure that the normative information is visible at all times while the lab users are working at the fume hood. Fume hood sash height data will again be collected during this period in order to determine if the presence of the normative information had any effect on the sash height of the fume hoods which are not in use. Energy data will also be collected for the duration of the study and for subsequent months as a means to determine if any behaviour change was lasting.

It was felt that this intervention suitably addressed each of the considerations which were highlighted in the literature above. Firstly, it is important to highlight to the target individuals in the lab that the desired behaviour of closing fume hoods is realistic and achievable. It is therefore important to illustrate to the lab users that individuals in other laboratories successfully engage in the closure of their fume hoods. In line with Blake's (1999) suggestion that practicality and Steg and Vlek's (2009) assumption that comfort and behavioural opportunities play an important role in terms of the perception of barriers to behaviour change, illustrating that others have successfully engaged in the desired behaviour may serve to reduce the perception of situational barriers to some extent. Secondly, in line with the focus theory (Cialdini et al., 1991), salient reminders of the desired behaviour of closing fume hoods were put in place in the form of ruler stickers which indicated sash height. This also addresses the point raised by Einstein and McDaniel (1990), that simple reminders in the environment may be sufficient to encourage behaviour change where a more notable change in context is not possible. Thirdly, as workplace

autonomy has been identified as being important in terms of fostering creativity (Sia & Appu, 2015) and wellbeing (Thompson & Prottas, 2006), it is important that any attempts to change behaviour are not viewed as forceful or compromising of lab users' autonomy. To that end, any strategies which are employed should be done so in a manner which will ensure that lab users retain their perception of behavioural freedom by having a sense of control over their own actions.

As identified by Lally and Gardner (2013), awareness of environmental cues aimed at habitual behaviour change are aided by an ability to self-monitor. In order to establish the extent of self-monitoring behaviours individuals possess, the self-monitoring scale (Snyder, 1975) can be used. Interestingly, understanding of self-monitoring of behaviours was also suggested by Kallgren and colleagues (2000) as an important consideration when applying normative interventions, as the degree to which individuals engage in self-monitoring is likely to impact to what extent additional factors, other than the targeted norm, will be focal in the environment on an individual level. Therefore, the current study will employ the self-monitoring scale (Snyder, 1975) in order to determine if lab users are high or low self-monitors and to determine if this may have any effect on any potential outcome. Further, as the use of fume hoods could be described as a habitual behaviour, the extent to which lab users are in the habit of closing their fume hoods will also be examined. The Self-Report Habit Index (Verplanken & Orbell, 2003) will be utilised in order to measure lab users perceived habit strength for closing fume hoods. Finally, as the efficacy of social norms can largely rely on the extent to which an individual relates with the referent group, establishing lab users group membership is another important aspect of determining potential confounding or supportive factors which may influence the response to the intervention. A scale designed to determine the self-reported group association or membership with relevant groups such as the chemistry department, chemists in general, for example, will be employed.

3.2.7 Aims and hypotheses

The aim of the current study is to determine whether the application of a descriptive norms intervention relating to the fume cupboard behaviour in other well-known universities, can impact the behaviour of laboratory users, resulting in greater incidences of closing fume cupboards when not in use by breaking the habit of leaving fume hoods open and forming the new habit of closing fume hoods. The study will focus on the observed sash height along with the mean energy consumption per fume hood in each participating laboratory and will examine the change in energy consumed by each fume hood across each time point. The available energy data constitutes the fume hoods alone, removing any potential noise in the data from other energy consumers in the laboratory such as lighting or computers. The study aims to examine whether the normative information alone is enough to incentivise behaviour change, in the absence of any personal or extrinsic motivation to change. The study also aims to determine if any potential effects of this intervention are maintained over a long-term period of several months.

It is hypothesised that the application of the intervention will have a reduction on energy consumption in the laboratory as a result of lab users closing the fume cupboards when not in use. It is also hypothesised, in line with previous findings that any effect of the intervention will be only temporary.

3.3 Study 1

3.4 Method

3.4.1 Ethical Approval

Approval was granted by the University of Bath Department of Psychology Ethics committee, Ref: 16-105.

3.4.2 Participants

Participants were approximately 45 chemistry lab users consisting predominantly of PhD and post-doctoral researchers. The figure of 45 was based on an estimate by the researcher

according to the number of individuals who were present in each lab during the thrice daily data collection periods. Accurate demographic information was not available as only 19 lab users completed the post intervention survey. However, based on the survey responses the mean age of participant was 25.7 years ($SD=3.16$), with males constituting 58% of respondents.

The study is conducted using nine laboratories in a single building which is part of the Chemistry Department in the University of Bath. The nine randomly chosen labs contained 42 fume hoods in total, constituting 53% of the fume hoods in that chemistry building. The labs were chosen at random based on the accessibility which was available to the carbon manager on the day of the implementation of the study. The labs were varied in terms of the amount of fume hoods in each, with six labs each containing six fume hoods, one lab containing four fume hoods, and two labs containing one fume hood.

3.4.3 Design and levels of analysis

3.4.3.1 Design

The study employed a within-subjects repeated measures design which compared five key time points. Time points consisted of two week periods of pre-baseline, baseline, intervention, post-intervention and eight months follow up. Table 1 describes the conditions for each of these time points. During each time point, a variation of five potential factors were present. These included the presence of the blank ruler stickers in the fume hood, the presence of the normative information ruler stickers in the fume hood, the observed measurement of the sash heights, the presence of the researcher in the labs to collect data, and finally, the collection of the VAV energy data.

Table 1: Description of Conditions at Time Points (Study 1)

	Pre- baseline (Time 1)	Baseline (Time 2)	Intervention (Time 3)	Post- intervention (Time 4)	8 month follow-up (Time 5)
Blank ruler sticker	✗	✓	✗	✗	✗
Normative ruler sticker	✗	✗	✓	✓	✓
Sash heights measured	✗	✓	✓	✗	✗
Researcher Present	✗	✓	✓	✗	✗
Energy data collected	✓	✓	✓	✓	✓

3.4.3.2 Levels of analysis

The study involved three distinct sources of data involving different levels of analysis which are defined as follows:

Survey data – this was data which was collected following the completion of the post-intervention period and consisted of responses from individuals who were working in the labs during the time of the study.

Observed fume hood data – this data was collected manually by the researcher and consisted of visual observations of fume hood sash height for fume hoods which were not in use at the time of the researcher visiting the lab. Each measurement which was collected was fume hood specific and was irrespective of who used the fume hood prior to the data collection. For the purpose of the study these observed values were averaged across fume hoods for each participating lab and pooled together for an overall value.

Energy use data – this was timestamp data pertaining to actual energy use of fume hoods. This data was on a laboratory level and was divided by the number of fume hoods in each respective lab in order to get a mean energy value per fume hood. For the purpose of the study these values were pooled across all nine labs unless otherwise specified.

3.4.4 Procedure

In advance of the study, lab users in the Chemistry Department were advised via email from the Departmental Head that there would be a visitor to the labs over the coming weeks who would be checking the ‘Variable Air Volume’ readings on the fume cupboards to ensure that the volumetric flow rates reported were consistent with sash position as part of a building management system check. Lab users were advised to continue to work as normal. This would not have been an unusual scenario and is unlikely to have aroused suspicion of the lab users.

For baseline data collection, the ruler stickers were placed on the inside cheek of the fume cupboards across eleven labs in the Chemistry Department. Typically, there is not one specific individual assigned to a specific cupboard within a lab, however lab users always worked from the same lab. The researcher recorded sash height of all fume cupboards, using the ruler as an accurate measure, three times per day for two weeks. It was also noted whether the fume cupboard was in use or not. In keeping with the cover story, VAV readings from each fume cupboard were also taken.

Following baseline data collection, the ruler stickers were replaced with similar stickers, however they now included the normative ‘not in use’ sash height from other institutions. Data collection continued in the same manner for a further two weeks. Following the study lab users were asked to complete an online survey whereby they were debriefed as to the purpose of the study.

3.4.5 Materials and Measures

3.4.5.1 Materials

Ruler stickers were designed by the researcher which were 50 centimetres in height, as this reflects the measurement of a fully open fume hood (see Figure 2a). These were placed on the inside cheeks of the fume hoods for the baseline data collection, in a position which

allowed them to be easily visible for both the lab user and the researcher while causing no disruption to the function of the fume hood or the equipment (see Figures 1a & 1b). Measurement was displayed in graduations of inches, centimetres and millimetres.

a) Marginally open fume hood



b) Fully open fume hood

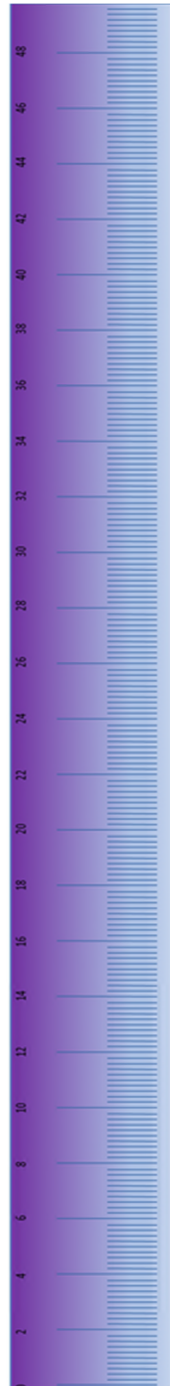


Figure 1a-b: Image of fume hoods with baseline ruler in place in the fume hood in both a partially closed and fully opened (50cm) position

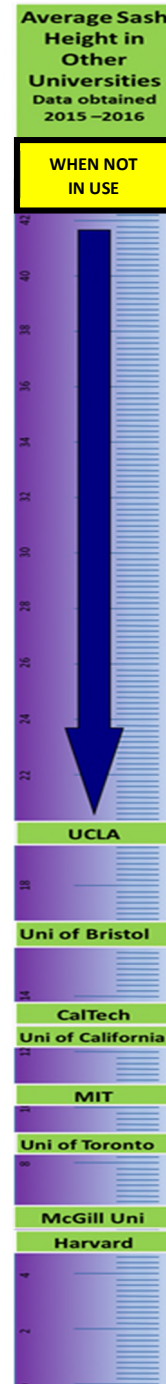
For the intervention phase, identical rulers were used with the addition of normative information about average sash height in other institutions and well-known universities around the world. These institutions included University of California, Los Angeles (UCLA), University of Bristol, California Institute of Technology (CalTech), The University of California, Massachusetts Institute of Technology (MIT), University of Toronto, McGill University and Harvard University. These institutions were chosen simply as there was fume hood information available for each of them. It was important to use actual data for the intervention as this represented realistic and achievable behaviour. This ensured that there was no deception of the lab users with regard to the normative information, thus ensuring that potentially unattainable levels of behaviour change were not being encouraged, and students were not misled in any way. This normative feedback was

gathered through freely available information on the websites of various universities who had reported the results of their fume hood campaigns and initiatives. The exception to this was the University of Bristol, as in this case the information was obtained by contacting the energy custodian who provided information on the average width opening of fume cupboards in their labs, as these were not the conventional vertical opening sashes but instead used horizontal opening sashes. In this case the percentage width opening was converted into a percentage equivalent for the vertical opening sash. It clearly stated at the top of the ruler sticker 'Average Sash Height of Other Universities when Not in Use (Data obtained 2015-2016)', with each university placed at their corresponding point on the ruler (see Figure 2b). For example, in Harvard, the average sash height when the fume hoods are not in use is 2 inches (5.08cm), therefore Harvard was placed at this point on the ruler.

a) *Baseline ruler sticker*



b) *Normative ruler sticker*



Figures 2a-b: Baseline and normative information ruler stickers

3.4.5.2 Measures

3.4.5.2.1 Survey

Self-Report Habit Index (SRHI: Verplanken & Orbell, 2003) is a 12-item self-report measure which assesses strength of habit for a specific behaviour. Participants are asked to respond on a seven point Likert scale ranging from *1 – Strongly agree* to *7 – Strongly disagree* with the neutral midway response of *4 – Neither agree nor disagree* the extent to which they agree with each of the statements. For example, an item for the current study is ‘closing the fume cupboard sash when I am not actively using it... is something I do without thinking’. Higher scores on the SRHI indicate higher levels of habitually engaging in the target behaviour of actively closing the fume hood. The scale was found to be highly reliable, $\alpha = .97$.

Self-Monitoring Scale (SMS: Snyder, 1974) is a 25-item self-report measure which examines the extent to which respondents engage in conscious impression management behaviours in social settings by means of altering behaviours in line with perceived situational demands. The scale traditionally uses a true/false response option. However, for the purpose of this study and in order to gather a more in-depth understanding of the self-monitoring behaviours of the lab users, the measure will be adapted to incorporate a 7-item Likert scale response option. The response options are as above. The adapted scoring scale which will be used for the measure equates scores of 75 or below with low self-monitoring, scores from 76 to 125 with moderate self-monitoring, and score from 126 to 175 with high self-monitoring. Reliability analysis showed relatively low reliability, $\alpha = .68$, which may be due to the small sample size.

Group membership Survey: A six-item questionnaire was compiled by the researcher in order to establish perceived group membership across various groups relevant to the study. The normative intervention is likely to be more effective should the lab-users consider their lab group and chemistry researchers in general to be part of their ‘in-group’. The

questionnaire asks the participants to rate how strongly they feel they are a member of each of six groups, namely; their lab group, the Chemistry Department, University of Bath, the postgraduate/PhD community, the broad scientific community, and chemistry researchers in general. Participants were asked to rate their level of membership on a five point Likert scale, ranging from 1- *Strongly agree* to 5 – *Strongly disagree*.

3.4.5.2.2 Sash height observations

For the observational sash height data collection for time point 2 (baseline) and time point 3 (intervention), the ruler stickers were used as an accurate measurement tool (see Figures 2a and 2b). During both of these periods, the researcher entered each lab three times per day, in the morning, afternoon and evening. The researcher observed the sash height of the fume hoods which were not in use during this time. A fume hood was considered to be not in use if there was no lab user standing in front of or working at the fume hood. Accurate measurements of the degree to which the fume hoods were open were taken using the ruler stickers and were recorded in centimetres. Measurement in centimetres was clearly visible on the ruler stickers, ensuring that the researcher did not need to touch or disturb the position of the sash during the observations and recording of the sash heights.

3.4.5.2.3 Energy use records

Long range real-time energy use data was also collected for each lab across the duration of the study relating to the variable air volume (VAV). This relates to the real-time airflow of the fume hood system and is directly related to the sash opening height, in that the greater the sash opening, the higher the VAV level. This is due to the necessity of the system to work harder to move the air than when the sash is closed. As the VAV reading relates specifically and solely to the fume hoods, heating or other energy intensive appliances in the laboratory will not influence this data. VAV data is available on a laboratory level, and was divided by the number of fume hoods per laboratory in order to obtain the average VAV per fume hood. VAV data is recorded in three to five minute intervals and runs twenty-four

hours per day including weekends and holidays. For the purpose of the current study, only data from weekdays within the working day (8am to 6pm) was used.

The data which was collected was focused over five time points (see Table 1). These time points represented the period two weeks before the study (T1 – pre-baseline), two weeks baseline data collection where the plain rulers were in place (T2 – baseline), two weeks during the intervention when the normative information was included on the stickers (T3 – intervention) where the stickers remained for the duration of the study, two weeks immediately following the study to assess any immediate returns to behaviour in the absence of the researcher (T4 – post-intervention), and finally two weeks which were collected at the end of the study, eight months following the initial implementation of the study to determine any long term impact of the intervention (T5 – post-eight months). The data collected during these phases represented the actual amount of energy consumed by the fume cupboards per lab across the day, while observed sash height data was collected for the period's baseline and intervention only (T2 and T3). The energy data consisted of timestamp data which was generated every three to five minutes, running 24 hours per day. For the purpose of this study, only output which was generated between the hours of 8am and 6pm was used, with weekends also being excluded to avoid any effects of the low-level weekend use being recorded. During the period of data collection, it is understood that there was little turnover with regards to lab users, however normative ruler stickers remained in place until data collection ceased which ensured that the intervention was present and visible for any potential new lab users.

3.4.6 Planned Analysis

A linear mixed model (LMM) was chosen to analyse the VAV data. The LMM was the most appropriate test for this data as it includes both the fixed effect of time point and the random effect of lab. This method allows for the dependencies in the data as a result of the repeated

measures yet also allows for comparison across lab groups. There are a number of advantages to running an LMM over other methods. For example, the LLM does not conduct list wise deletion to deal with missing cases, but instead makes use of all of the available data (Edwards, 2000). Further, as opposed to simply exploring differences across time points, as is the case with the repeated measures ANOVA, the LMM illustrates the patterns of change across time, as well as providing information on individual differences (Krueger & Tian, 2004), in this case, for each lab.

The model recommends the removal of outliers (Lesaffre & Verbeke, 1998). A stem and leaf plot indicated eight outliers in the data, however a conservative approach was taken and just five of these outliers were removed as the remainder were within the expected range of values.

3.5 Results

3.5.1 Survey

Of 25 respondents who began the survey, six had to be removed due to incomplete or missing responses. Due to the low representation of lab users who completed the survey the results must be interpreted with caution. Of the usable responses 42% were female and 58% male. Ages of participants ranged from 21 to 33 years old ($M = 25.7$, $SD = 3.16$). The majority of survey respondents worked in their current lab for under 1 year (36%), while a further 31% worked there for 1-2 years. 22% worked there for 2-3 years, with a further 5.5% each working there for 3-4 years and 4-5 years.

Respondents scored relatively low on the Self-Report Habit Index ($M = 4.69$, $SD = 1.37$), showing that the average response lies between the neutral midpoint and ‘somewhat agree’. This would suggest that there was no strong habit of closing the fume hood sash when not actively using it.

Scores on the Self-Monitoring Scale indicate similarly ambiguous levels of self-monitoring ($M = 4.10$, $SD = .46$). This shows the respondents were on average close to the neutral midway point of ‘neither agree nor disagree’.

The group membership questionnaire showed that the group which respondents reported strongest feelings of membership in was their lab group ($M = 4.75$, $SD = .433$), with chemistry researchers in general being the second highest choice ($M = 4.4$, $SD = .611$). However, the range for lab group was much smaller (1) than for the chemistry researchers (3). The group which scored the lowest was the postgraduate community ($M = 3.85$, $SD = .833$) indicating the average response fell between respondents somewhat agreeing and neither agreeing nor disagreeing that they felt a strong sense of group membership with the post-graduate group in general. The mean responses for each group are represented in Figure 3 below.

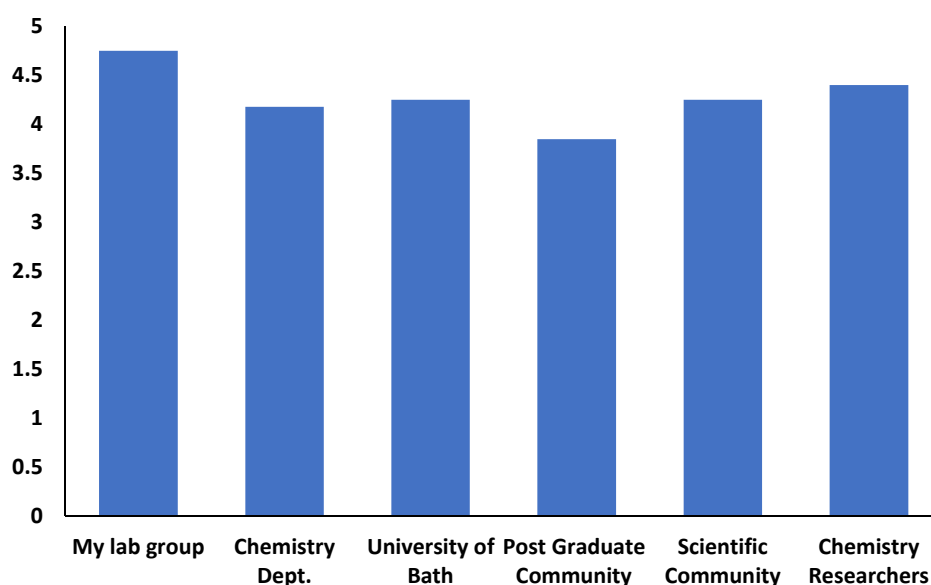


Figure 3: Mean scores for self-reported group membership

A correlation analysis was run which found that there was no relationship between scores on the SRHI and the SMS, $r = -.248$, $p = .352$, indicating that the extent of respondents self-reported habit of closing the fume hood when not in use was not related to levels of self-monitoring of behaviour.

3.5.2 Observed Sash height

Average sash height was recorded (in centimetres) for each of the 42 participating fume hoods for the baseline and intervention periods. A paired samples t-test was conducted to evaluate the impact of the normative intervention on fume cupboard sash height (see Figure 4). There was a statistically significant decrease from baseline data collection ($M = 21.74$, $SD = 7.97$) to intervention ($M = 13.29$, $SD = 6.5$), $t(41) = 9.35$, $p = <0.001$.

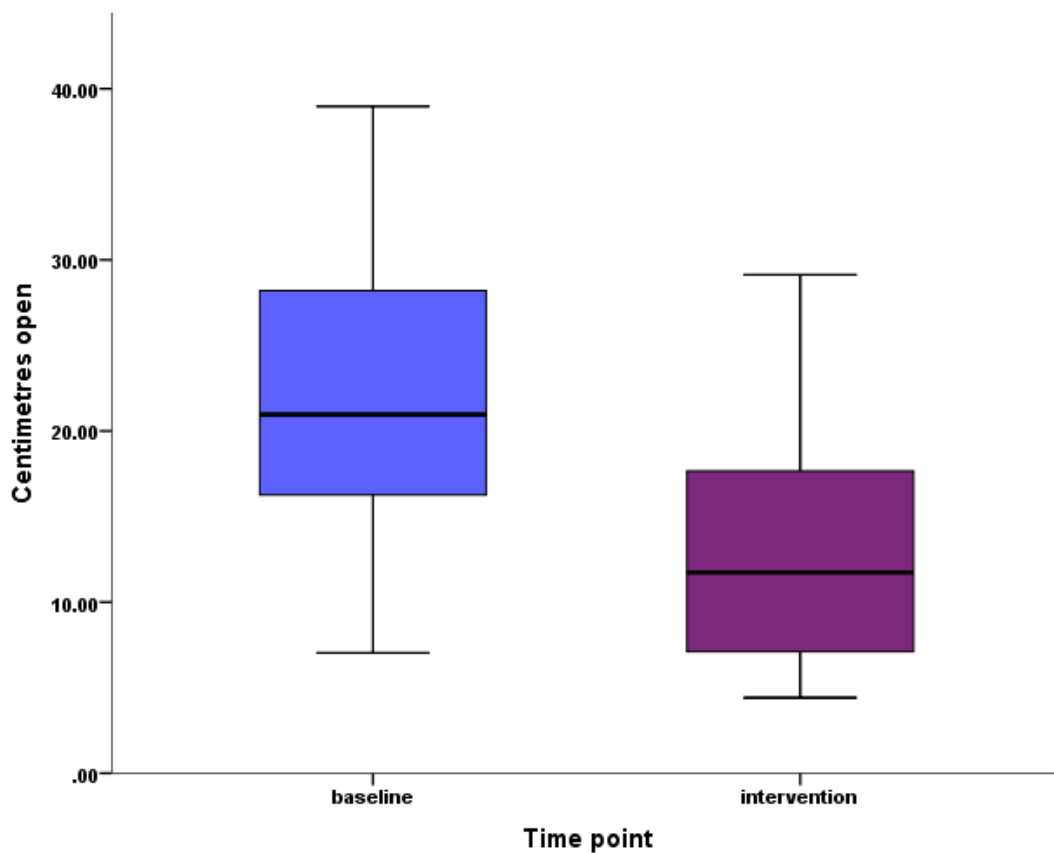


Figure 4: Difference in observed sash height (centimetres) for fume hoods which were not in use from baseline to intervention

3.5.3 Energy Use

Variable Air Volume data for each laboratory was compiled and averaged per working day and is presented in a bar chart below (Figure 5). Within the chart five periods of interest are highlighted which consist of pre-baseline (T1), baseline (T2 blank rulers), intervention (T3

norm rulers), post-intervention (T4 norm rulers), and eight months post intervention (T5 norm rulers).

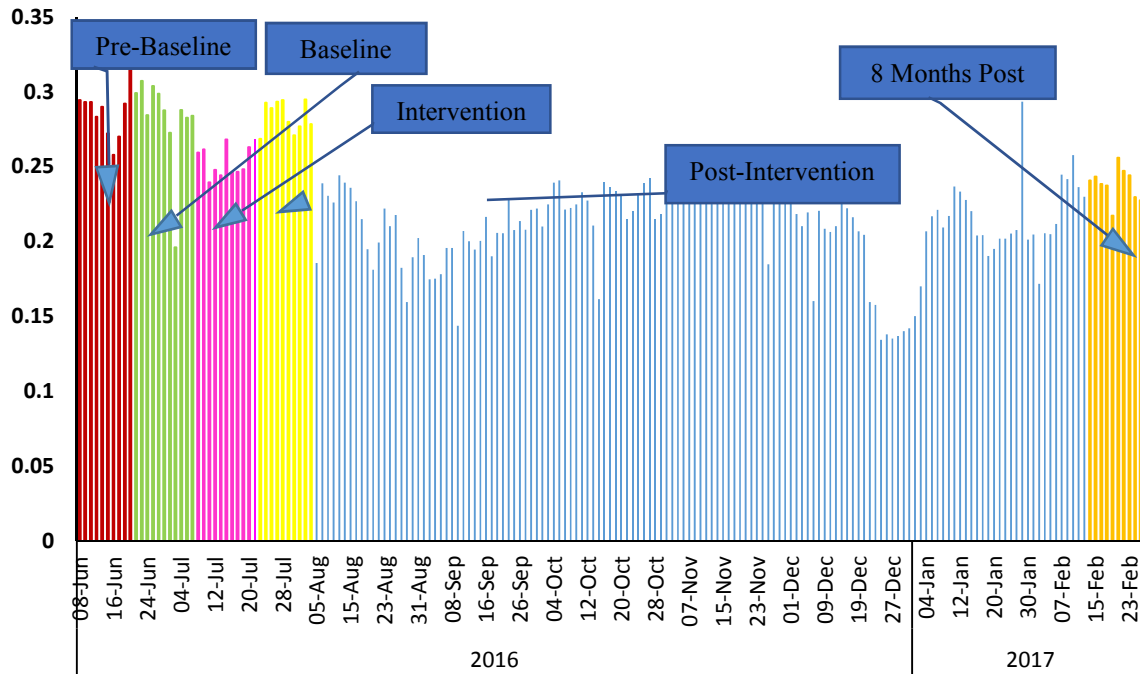


Figure 5: Combined daily mean VAV bar chart with periods of interest highlighted

3.5.3.1 Inferential statistics

A series of planned linear mixed models were conducted in order to detect change across time and to determine if there was any effect of which lab participants were in. ‘Time point’ was used as the fixed factor and ‘Lab number’ as the random factor. It was necessary to check changes across time from both the baseline time point, and the intervention time point. Therefore, two linear mixed models were run. Analysis began with the creation of null models, with the fixed and random effects of lab and time point added. Best fit was determined using the log-likelihood ratio.

The findings showed that there was a significant main effect of time point, $F(4, 304) = 11.54$, $p < .001$. Log-likelihood ratio = -1058.003. From the bar chart (See Figure 6) it can be seen that despite a reduction in VAV value from Pre- Baseline (T1) to Baseline (T2), this

reduction was not significant, indicating that the effect of time point was not present from pre-baseline to baseline period of data collection ($p=.413$). Further, from Pre-Baseline (T1) to Intervention (T3) there was a significant reduction ($p<.001$) showing that the implementation of the intervention resulted in a significant decrease in VAV values. Finally, from Pre-Baseline (T1) to Eight Months Post-Intervention (T5), there was a significant reduction, ($p<.001$) showing the long-term reduction in VAV values across the study period.

There was no significant main effect of lab, $p=.073$. This non-significant effect can be seen through Figure 8, which displays the mean VAV reading for each lab across each time point, which clearly shows differences in terms of patterns across time for each lab. However, there was a significant interaction effect of time point and lab, $F(31, 277) = 16.34, p<.000$.

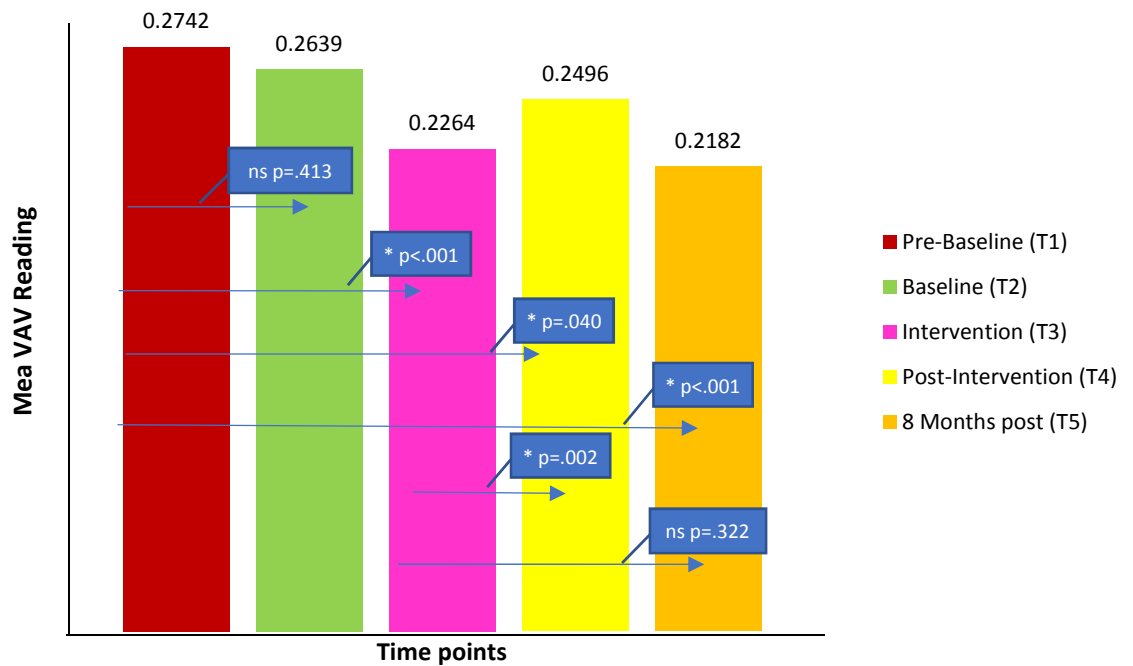


Figure 6: Bar chart showing significant and non-significant effects between time points of interest according to the linear mixed model

It can be seen from the bar chart that there was an apparent increase from Time 3 to Time 4. In the interaction model, it was found that this increase was significant, $p=.002$. Post-intervention (T4), however is still shown to be significantly less than Pre-baseline (T1),

$p=.040$. In Figure 7, which displays the change in mean VAV values across each time point, there is a relatively similar pattern for each lab up to Time 3. At Time 4 there is an apparent divergence with labs behaving differently, which explains the lack of a significant increase from Time 3 to Time 5, indicating that by the last data collection point, VAV levels were not significantly different from the intervention phase, $p=.322$.

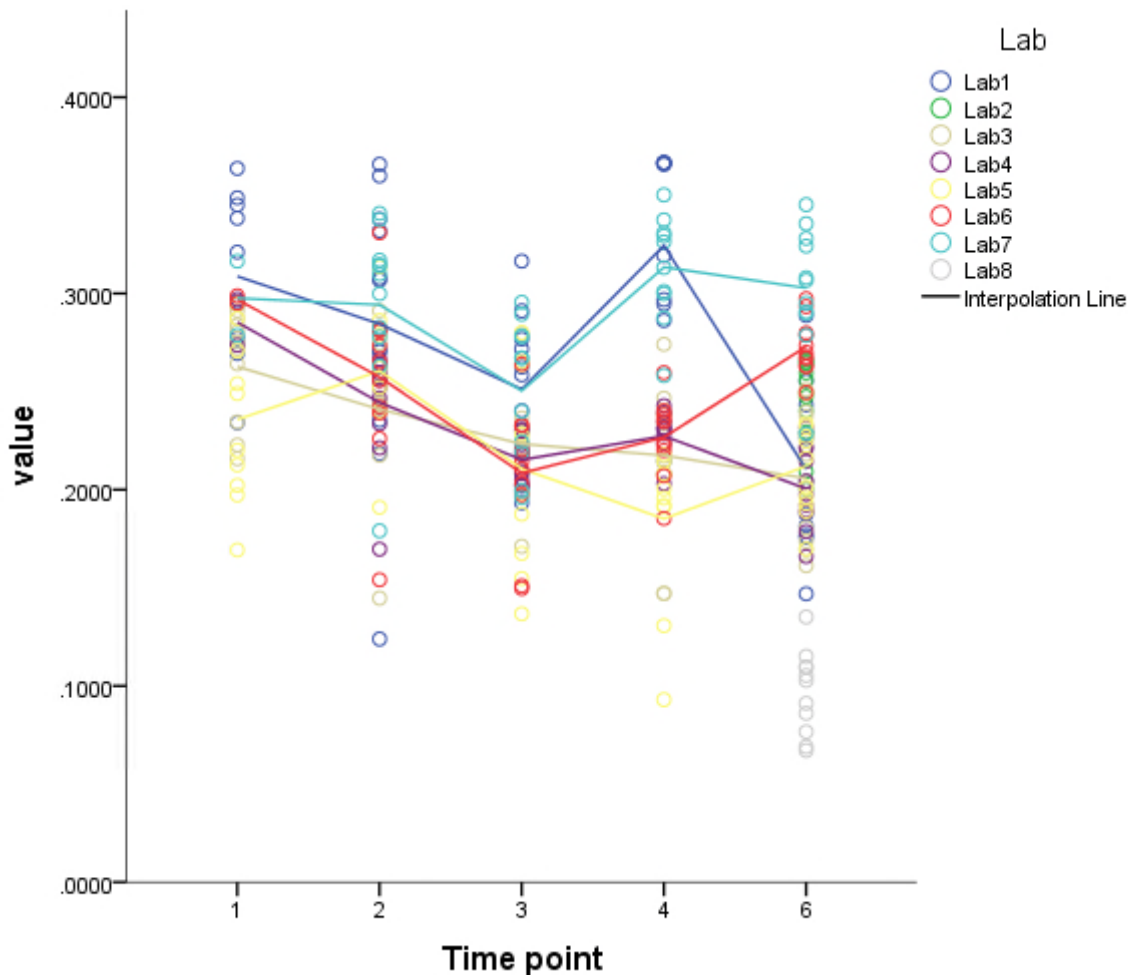


Figure 7: Scatterplot with interpolation line showing mean values VAV values at each time point for each lab

In order to understand the differences in behaviour across time for each lab, the data have been normalised by transforming them so each lab begins at a common time point. This will allow the pattern of change across time to be clearly visible for each lab (see Figure 8). Visual analysis of the line chart reveals that Lab 1 represents the canonical typology, in that from Pre-Baseline (T1) to Baseline (T2) there is a small reduction which increases at the Intervention phase (T3). There then appears to be a moderate return to behaviour or

reactance at Post-Intervention (T4), with 8 Months Post-Intervention (T5) showing increasingly lower VAV values.

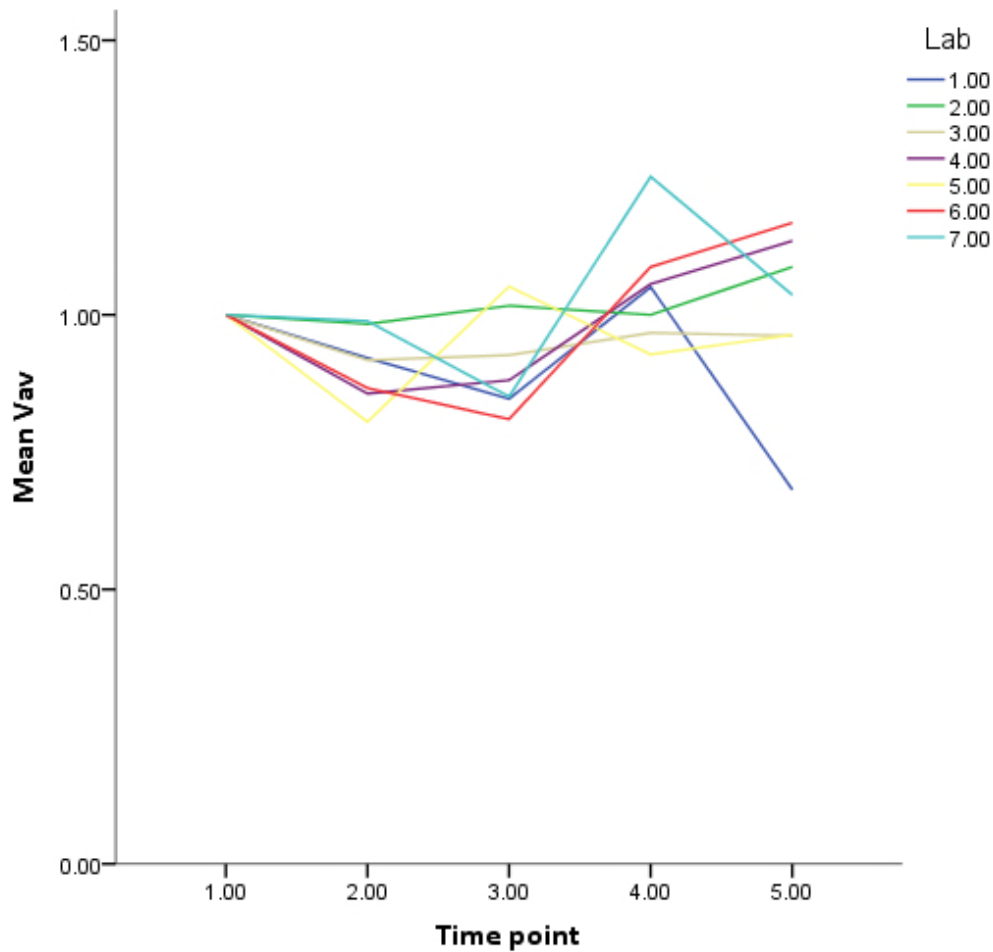


Figure 8: Normalised line chart showing mean VAV values for each lab from a common starting point across five time points

At Post-Intervention (T4), possible reactance is evident from Labs 1, 4, 6, and 7, with a particularly dramatic increase from Lab 7. Upon inspection of the figure, Lab 5 appears to be the most anomalous, in that the trend does not follow that of any other lab, other than from the initial pre-baseline to baseline phase. From the initial scatterplot (Figure 7) it would appear that Lab 5 largely follows the trend of the other labs in terms of the pattern of VAV values, however, when the data is normalised (Figure 8) it is apparent that Lab 5 unexpectedly shows a dramatic spike at the intervention period. This may be explained as a result of there being only one fume hood in Lab 5, potentially reducing the extent of normative influence which is present in the other labs due to the greater number of lab users both being visible and able to see behaviour.

3.6 Study 1 Discussion

The results of Study 1 yielded interesting findings; while there was an initial response to the implementation of the baseline measure of the blank ruler sticker (T2), this became far more pronounced following the addition of the normative information for the intervention phase (T3). While this finding may be relatively unsurprising, following the cessation of the observational data collection, resulting in the researcher no longer visiting the lab to measure the fume hood sash height, there was a clear spike in VAV readings (T4). This might indicate some level of potential reactance, which may have been caused by the lab users regaining a sense of autonomy with regards to their workplace behaviour as a result of this no longer being visible to the researcher. However, this apparent reactance was short-lived and behaviour returned to levels which were actually lower than during the intervention period following this. Therefore, while there was a temporary spike in the target behaviour, it would appear that the effect of the descriptive norm was sufficient to change fume hood closure habits as seen through the long-term effect found to be present eight months following the intervention (T5).

3.7 Study 2

Study 1 in the current chapter showed that by providing a descriptive normative message to lab users which highlighted fume hood closure behaviour in several other universities, this resulted in a significant reduction in energy consumption which was found to be long lasting. This showed the effectiveness of providing normative information in the workplace where no personal incentive to change is present. As this strategy presents a potentially low-cost high-return method of behaviour change which could see a significant impact on the carbon footprint of chemistry laboratories, it is important to ensure that the intervention can be appropriately validated.

While it would appear that the intervention was highly effective, the spike in VAV readings following the end of the researchers in-person data collection phase must not be ignored.

Initial interpretations of the cause of this spike in behaviour lead to the assumption that this may have been a reactance response, whereby lab users may have felt a sense of being monitored during the data collection in the intervention phase. It could be assumed that when the descriptive norms stickers were placed in the fume hoods, lab users may have become aware of the aims of the researcher as well as the purpose of the stickers and the regular presence of the researcher. Lab users may have responded by increasing their engagement in the target behaviour as they were aware they were being monitored. Following this period, with the researcher no longer visiting the lab to take sash height readings, lab users may have felt the desire to exercise greater autonomy over their behaviour by reverting to their original actions of leaving the fume hoods open when not in use. However, it cannot be said with certainty what the cause of this spike and return to behaviour was.

Study 2 will therefore aim to establish if the presence of the researcher had an impact on the overall and long-term effect of the intervention. Study 2 will replicate the methodology of Study 1, however the researcher will not collect observed sash height data in order to determine if removing the researcher from the intervention will result in the same effect as was found in the previous study. Should the replication indicate no spike in behaviour following the application of the normative stickers, this will illustrate if the pattern seen in Study 1 was indeed a reactance response to the researcher as a result of being monitored.

3.8 Method

3.8.1 Participants

Participants were unidentified lab users, consisting predominantly of PhD and post-doctoral researchers, in the Chemistry Department in the University of Bath. Care was taken to ensure that targeted lab users had not participated in the research in Study 1 by using different labs. Lab users worked exclusively in specific labs so there was no risk of any lab user inadvertently participating in both studies.

3.8.2 Design

The study employed a within-subjects repeated measures design which compared four time points. Time points consisted of three week periods for pre-baseline, baseline, with two weeks for the intervention phase so as to be directly comparative to Study 1. A final two-week period was analysed to detect the long term impact at three months following the intervention. Table 2 describes the conditions for each of these time points.

Table 2: Description of conditions at each time point (Study 2)

	Pre-baseline (Time 1)	Baseline (Time 2)	Intervention (Time 3)	3 Month Follow Up (Time 4)
Blank ruler sticker	×	✓	×	×
Normative ruler sticker	×	×	✓	✓
Sash heights measured	×	×	×	×
Researcher present	×	×	×	×
Energy data collected	✓	✓	✓	✓

3.8.3 Materials and Measures

3.8.3.1 Materials

Materials which were used were identical to those used in Study 1, which consisted of blank ruler stickers for the baseline time point, which were then replaced by the descriptive norms ruler stickers for the intervention phase.

3.8.3.2 Measures

Energy use records identical to those used in Study 1 were the sole method of data collection for this study. Corresponding time periods were selected which denoted weekday working hours.

3.9 Procedure

The procedure was similar to that in Study 1, however there were some notable differences in the current study. The researcher was not present and did not collect sash height data. Rather, energy data only was collected (VAV readings). As a result, lab users were not aware of their fume cupboard behaviour being monitored or recorded by an external individual as was the case in the previous study.

In order to keep the research as similar to the previous study as possible, the baseline blank ruler stickers were put in place, this time for a period of three weeks. Following this, they were replaced with the descriptive norms stickers. Fume hood sash behaviour was therefore only monitored through the analysis of the VAV data.

3.10 Results

VAV was again compiled for each laboratory and a mean value for each working day was calculated. Four time periods were analysed which consisted of pre-baseline (T1), baseline (T2 blank rulers), intervention (T3 norm rulers) and three months post intervention (T4 norm rulers). These periods are highlighted in the bar chart below (Figure 9). The researcher was not present for any of the time points.

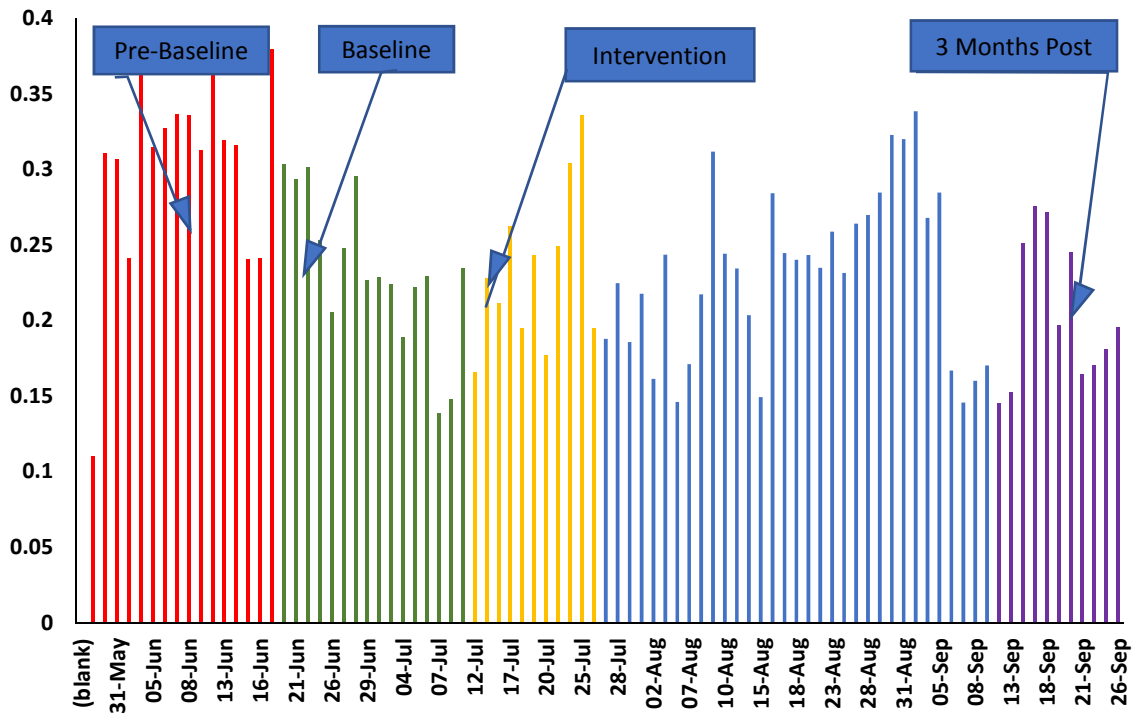


Figure 9: Combined daily mean VAV readings with four time points highlighted

3.10.1 Inferential statistics

A linear mixed model was again chosen to analyse the data. This was deemed to be the most suitable method of data analysis as it allowed exploration of effects using the fixed effect of time and the random effect of lab, as in Study 1. This main aim of running the analysis was to check the changes across time from the pre-baseline time point in order to determine any patterns of change as a result of the addition of the intervention at both baseline (T2) and intervention (T3) stage. A model was also run to check change across time from T2 and T3. Best fit log-likelihood = 4039.476.

The findings show that there was a significant effect of time point, $F(3, 5469.04) = 60.48$, $p < .001$. The model also showed that there was a significant decrease from Pre-baseline (T1) to T2, T3 and T4, $p < .001$, in each case. This is illustrated in the bar chart below (Figure 10). There was a significant random main effect of lab, $p = .026$. It was also found that there was a significant interaction effect, $F(43, 5439) = 261.85$, $p < .001$. Visual inspection of the graph indicates an increase from T2 to T3, however it was found through that this increase was

not significant, $p=.089$. It was also found that the reduction from in VAV readings from T3 to T4 were significant, $p=.010$. Finally, it was found that the change in VAV from T2 to T4 was also not significant, $p=.264$.

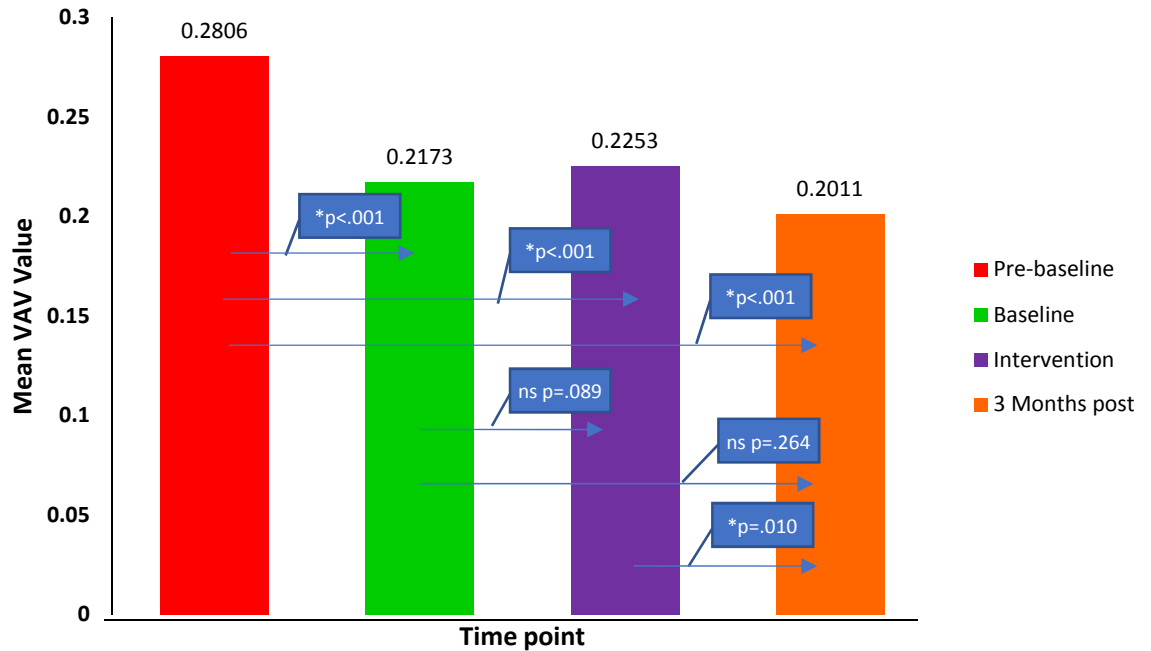


Figure 10: Mean VAV value per time point for Study 2 with significance levels for the linear mixed models noted

Figure 11 shows the change in VAV reading across each time point for each separate lab. While it would appear from visual inspection of the figure that Lab 4 may be an outlier, a decision was made to not remove this lab from the analysis as the VAV readings represented realistic values, as following the intervention it was shown that the readings were reduced to similar levels to that of the other labs. Analyses were rerun with Lab 4 removed, however the model was still shown to be significant in terms of main effect of time, random effect of lab and interaction effect.

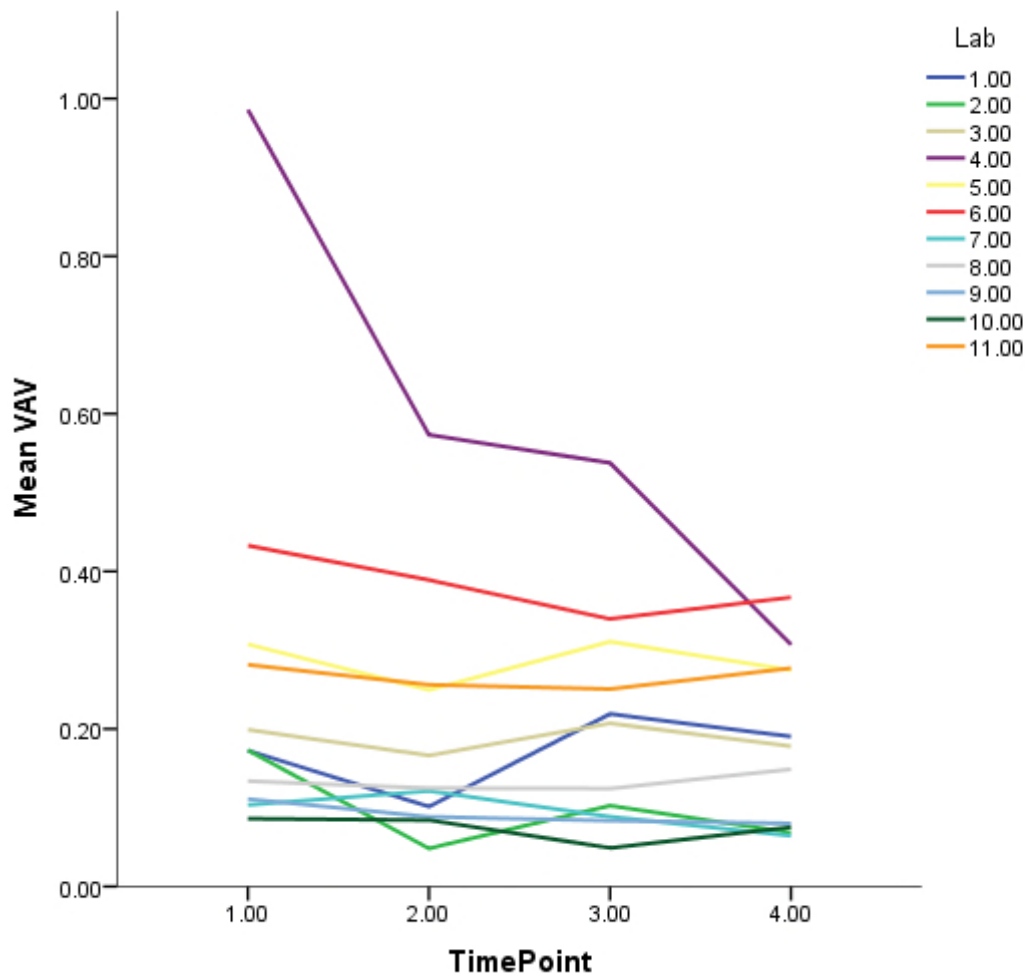


Figure 11: Line graph showing mean VAV reading for each lab at each time point

3.11 General Discussion

This study aimed to determine if, in the absence of personal incentives, a social norms intervention could effectively induce a meaningful change in wasteful laboratory energy consumption over a long period of time. The study aimed to establish whether it would be possible to break the cycle of the repetitive and habitual behaviour of leaving fume hoods open without any explicit change in context or environment, beyond the application of the intervention sticker. This intervention attempted to change behaviour without the presence of tailored messaging targeting values or environmentally focussed framing, but rather, relied simply on the effect of social influence through normative messaging alone. It also attempted to implement an intervention which could overcome the potential barriers to workplace behaviour change.

In order to validate the method following the results of Study 1, Study 2 presented a replication study which aimed to determine if the presence of the researcher during observational data collection periods had any influence on the pattern of behaviour change. It was anticipated that should Study 2 yield findings which corresponded to those in Study 1 in the absence of the researcher, this would suggest that the descriptive norms stickers could be a viable and cost-effective method of laboratory behaviour change which could be rolled out more widely. However, it was also considered that should a different result occur in Study 2 that this could suggest that the influence of the researcher must be considered further. It was found that there was a significant reduction in VAV energy use as a result of the intervention, however this appears to have occurred as a result of differing sources of influence in each study. The findings of both Study 1 and Study 2 will be discussed below individually before a more critical comparison will be presented.

3.11.1 Study 1

In Study 1, the data showed that there was a significant effect of the intervention with a reduction in sash height of approximately forty percent from the baseline to intervention period according to the observational sash height data. There was also a significant and long-lasting reduction in energy consumption, as seen through the VAV data. A significant reduction in VAV readings from baseline remained up to eight months after the initial application of the intervention, suggesting that the intervention was robust enough to potentially form a new habit of fume hood closure. This indicates the utility and effectiveness of a social norms intervention for significant and long-term energy reduction in the laboratory.

The application of the blank ruler stickers at T2 (baseline) resulted in a decrease in VAV readings indicating that perhaps lab users had become aware to some extent of their fume hood use through objective measurement using the rulers. However, despite a visible

reduction, this was not found to be significant, but interesting to note this response nonetheless. Due to the location of the rulers it is unlikely that lab users were unaware of their presence when working at the fume hood so it is likely that this could be the cause of the behaviour change. However, it could also be suggested that the presence of the researcher was in fact the cause of this change in behaviour which may have come about irrespective of the presence of the ruler stickers. This could be explained as a type of behavioural response bias, similar to that which may be seen in self-report measures (Furnham, 1986) or simply as a result of the Hawthorne effect, in that as the lab users knew they were being watched, this resulted in a behaviour change (Adair, 1984). As both of these potentially confounding variables occurred concurrently, it cannot be said with certainty whether it was the presence of the researcher or the presence of the rulers which may have caused the change in behaviour, or indeed an unmeasured confounding factor.

Following this period (T2), the descriptive norms information replaced these blank rulers which saw a significant reduction in VAV readings. It is evident that the provision of this normative information about how other universities engage in fume hood closure provided an additional dimension of influence, resulting in a notable change in fume hood behaviour. This shows that beyond the initial change in behaviour, the addition of the descriptive norms resulted in substantial reductions in VAV readings, suggesting that the normative influence was an effective behaviour change tool with regards to increasing fume hood closure. This supports the first hypothesis that the intervention would result in energy savings as a result of lab users increasing the extent to which they close the fume hood sash when the fume hood is not in use.

Visual inspection of Figure 5 indicates that following both vacation periods in August and December there was a slight return to behaviour which petered out soon thereafter. The findings show that despite these periods which evidenced an apparent trend back towards baseline behaviour following the breaks and the cessation of the presence of the researcher,

there was still long-term behaviour change. Average energy use eight months after the implementation of the intervention was still significantly lower than at pre-baseline periods. This indicates a longer lasting impact in terms of persistence of behaviour change than was found by Feder and colleagues (2012) in their fume hoods study. This suggests the descriptive social norms intervention employed here has the potential for greater longevity in terms of effectiveness than previous similar research for this specific type of desired behaviour change. We can therefore reject the second hypothesis which predicted that any change in behaviour would be temporary, as the findings here show that there is a long-term, potentially habitual increase in fume hood closure following the intervention.

3.11.1.1 Survey Data

As there were only 19 usable responses to the online surveys, the findings from these measures are best interpreted with caution and may not be generalizable. However, this sample size represents approximately 40% of the lab users that were involved in the study. The lack of a fully representative sample may go some way to explaining the surprising findings in terms of the survey data for the SMS and the SRHI when compared with the energy data. Participants were found to be at the neutral midway point in terms of responses on both the SMS and the SRHI. This is somewhat surprising as it could be expected that high self-monitors would respond to a normative intervention. Similarly, despite not reporting habitual fume hood closure in the SRHI, habitual closure of the fume hood appears to have occurred by the eight month follow up period. This, again, has important implications for future research and supports Holland and colleagues (2006) suggestion that in the absence of a suitable contextual change, the inclusion of an eye-catching situational cue, in this case, the colourful stickers which highlighted the normative information about other universities, may be sufficient to facilitate behaviour change and the formation of new habits. Furthermore, the existence of a simple reminder in the environment may have also served as a consistent prompt to the lab-users to engage in the behaviour (Einstein & McDaniel, 1990). However, it cannot be said with certainty if a new habit was formed as

this was not measured objectively following the eight month point at the end of the data collection.

The findings of the group membership questionnaire give important insight into potentially influential groups for lab users. The groups which were given the highest ratings comprised the individuals own lab group, chemistry researchers in general and the University Chemistry Department, respectively. This appears to show the very strong sense of connection with other chemists, and less so in terms of groups outside of this specific area. To that end, it appears the use of a social norms intervention which focused on the behaviour of other chemists was a suitable strategy and is likely to have been more effective than had a more general focal group been chosen. This may have important implications for future similar research, in that it is important to establish the referent group which the target individuals most strongly relate to, as this is likely to strengthen the impact of any normative influence. However, it must also be noted that for each group which was rated for levels of self-reported membership, at least low levels of group membership were self-reported for each group.

3.11.1.2 Effectiveness of descriptive norms in the workplace

Descriptive norms, in line with a vast array of literature, have been shown to be effective in terms of reducing the extent to which lab users leave their fume hoods open when they are not in use. This change in behaviour appears to have occurred in the absence of any personal enticements, as the intervention simply involved the presentation of information relating to the behaviour of chemists in various other universities. The findings therefore support previous literature which has shown the efficacy of descriptive social norms with regard to pro-environmental behaviour change. The findings of the current study also highlight the effectiveness of the descriptive normative intervention in a real-world setting, and did not involve the use of a manipulated environment, as has been the case with some previous social norms studies, such as those on littering (Cialdini et al., 1990), for example.

Furthermore, the intervention was shown to be useful without compromising safety in the laboratory. The findings also illustrate the utility of a descriptive norms intervention in the workplace, in the absence of any incentive for behaviour change. This may indicate the value of descriptive norms in a wider variety of settings and workplaces where it is not possible to incentivise change through personal rewards.

The use of the descriptive norms intervention appears to have largely overcome the potential challenges and barriers to workplace behaviour change as outlined earlier. Although previous research (for example, Young et al., 2015; Kaplowitz et al., 2012) has suggested that the use of financial incentives may be a suitable strategy for pro-environmental behaviour change in the workplace, the current study demonstrated that a financial or tangible incentive was not required in order to achieve the desirable outcome. The benefit of not requiring such rewards to encourage behaviour change of this type is that participants do not become reliant on a reward system in order to engage in the desired behaviour, and this reduces the risk of a crowding out or over-justification effect (Frey & Jegen, 2001; Lepper, Greene & Nisbett, 1973) which can have a negative impact on any pre-existing intrinsic motivation. Moreover, the success of the intervention in the absence of motivational rewards highlights the cost-effectiveness of this strategy and eliminates the necessity of the potentially costly maintenance of rewards over time. This is a particularly important point to note when considering to date, the most popular method to encourage fume hood closure is the 'Shut the Sash' campaign. This system provides regular rewards for the best performing lab, but requires maintenance and monitoring, as well as costs associated with the rewards. Avoiding a reward system also ensures that there is a lower likelihood of incidences of goal disengagement, whereby an unrealistic target may result in the abandonment of any effort to engage with the desired task (Wrosch et al, 2003).

The use of the normative message also addressed the issue of responsibility, as defined by Blake (1999) showing individual behaviour can result in group level change. The issue of

the practicality of the behaviour was also highlighted, as by showing lab users through the use of the stickers that other chemistry labs have managed to achieve the desired behaviour, this is likely to have made the target behaviour more attainable. While comfort and effort have been found to influence pro-environmental behaviours (Steg & Vlek, 2009), highlighting the prevalence of the behaviour elsewhere may serve to reduce any perceptions or misperceptions about the difficulty of closing fume hoods.

3.11.1.3 Post-Intervention Behaviour Spike

Following the intervention phase, and the cessation of the observed data collection, a spike or return to behaviour occurred temporarily. While the intervention stickers remained in place, at this point the researcher no longer entered the labs to collect sash height data. This spike can be seen in Figure 5 immediately following the termination of the researcher's presence in the labs, which would appear to imply that this increase in undesirable behaviour may have been in some way related to this factor. The increase in energy use during this period was a significant rise from the intervention period (T3) immediately preceding this time. It could therefore be speculated that some level of psychological reactance or indeed moral licensing may have occurred, which might have resulted in this return to undesirable behaviour.

Despite attempts at reducing potential reactance or deviance as a result of the intervention through the use of a subtle, unobtrusive and non-forceful approach, reactance may have occurred nonetheless. This may have occurred as a result of the potential perception of a threat to autonomy in terms of workplace behaviours (Brehm, 1966), as a result of the monitoring of behaviour by the researcher.. There may, alternatively, have been elements of moral licensing evident as a result of having previously engaged in the 'desirable' behaviour (Monin & Miller, 2001).

Similarly, the phenomenon of vicarious moral licensing should also not be overlooked. This refers to the effect of the good behaviour of the referent group, giving the individual a

license to behave in the opposite manner, as their in-group have already established a 'good name' (Kouchaki, 2011). Goldstein and Cialdini (2007) also discuss the phenomenon of vicarious self-perception, whereby individuals look to others in their group with whom they strongly identify with, and perceive the behaviour of the group as though it had been engaged in by themselves. The visibility of other lab users closing their fume hoods during the intervention period, coupled with the newly available information relating to the moral behaviours of lab users at other universities may have resulted in this outcome. It could be interpreted that having perceived that the group had already established a good name collectively, this may have licensed engagement in the undesirable behaviour on an individual level.

3.11.2 Study 2

Study 2 aimed to determine if a social norms intervention would be effective in the absence of knowledge of behaviour monitoring, building on Study 1, with the omission of the presence of the researcher recording sash height. The result again showed a significant reduction in VAV levels, however this was ultimately achieved following the application of the baseline ruler stickers and did not improve upon the inclusion of the normative information.

While it is unclear as to what caused this initial dramatic reduction in sash height following the implementation of the blank rulers, some speculative interpretations are discussed below.

Unlike Study 1, it was found that there was no spike in VAV readings at any point during the study. This would appear to suggest that the spike in Study 1 could be a reactance response to the researcher as this was the key difference between the two studies. This addresses the main aim of this study and seems to show that perceived monitoring of behaviour may result in some undesirable responses.

3.11.3 Comparison of Study 1 and Study 2

Individually, the findings of study 1 and study 2 present interesting results, both of which show a significant change in fume hood behaviour, leading to a substantial reduction in VAV readings following the implementation of the intervention. However, there was a clear difference in the pattern of behaviour change across time points between the two studies which must be explored. The change in behaviour across each time point has been presented in a line graph below allowing for ease of comparison (see Figure 12). Both studies have time points representing pre-baseline, baseline, intervention and a long-term follow-up, however, Study 1 also has a post intervention time point which was necessary to mark the end of the period where the researcher was present. The interpretation of this will be discussed below.

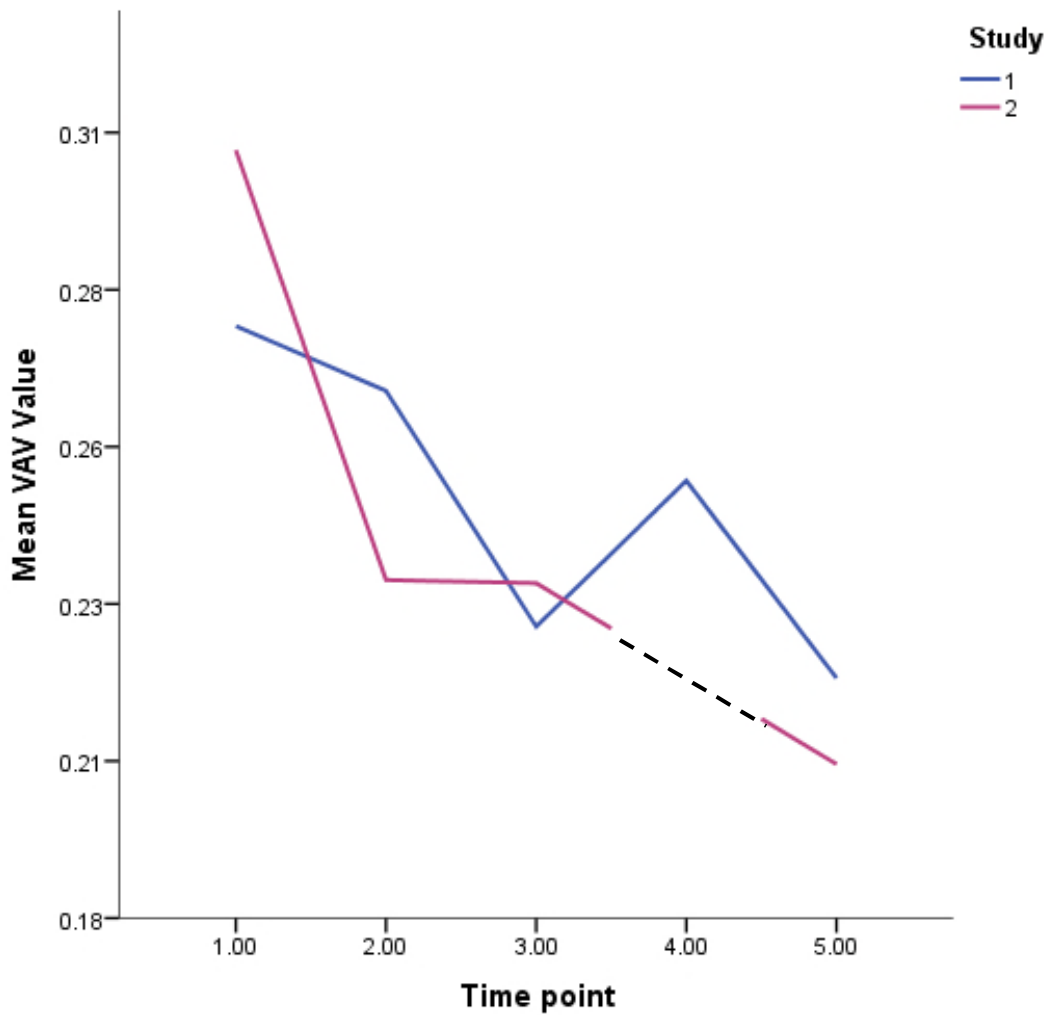


Figure 12: Line graph comparing each time point for Study 1 and Study 2 with broken line denoting 'post intervention time point' which was not present for Study 2

While there appears to be a dramatic difference in the behaviour of lab users from Study 1 to Study 2, it must be noted that the only difference in the manner in which the studies were operationalised was that the researcher was not present for Study 2. On the most fundamental level, it could therefore be suggested that the results of Study 1 represent a response which has been somewhat inhibited by the presence of the researcher. On the other hand, Study 2 presents the natural behaviour of the lab users, in response to the intervention and without the influence of a possible perception that their behaviour was being monitored by the researcher. It is evident from Figure 12 that in Study 1 there was a reduction at T2, when the baseline blank rulers were fitted and the researcher was present, although this reduction was not found to be significant in the model. However, the inclusion of the

normative information at T3 did result in a significant reduction in VAV, apparently showing the response to the descriptive normative information. In Study 2, the implementation of the blank baseline rulers at T2 resulted in a significant reduction, yet the addition of the normative information at T3 did not result in a further meaningful drop from T2 levels. Visual inspection of the combined figure shows that at T2 in Study 2, VAV readings were already at a level which was similar to those at T3 for Study 1.

While these findings show that the operationalisation of both studies ultimately led to a similar level of reduction in VAV reading, there were clear differences in how this was arrived at from Study 1 to Study 2. It could be anticipated that the application of the blank ruler stickers would show some negligible effect, but that the addition of the normative information would result in a more pronounced change, as was found in Study 1. However, it was found in Study 2 that the blank rulers elicited a dramatic reduction in VAV readings with no significant difference following the addition of the normative information. While the only difference in methodology relates to the presence of the researcher it cannot be stated with certainty what the specific cause of the differences in behavioural responses was. Some possible interpretations of why this discrepancy may have occurred are presented here.

3.11.3.1 Cover story

Prior to running Study 1, all lab users were notified via email from the Head of Department that there would be inspections of the fume hoods over the coming weeks which would require ruler stickers to be placed in the cheek of the fume hoods. This was to ensure lab users behaviour was not impacted by the presence of the researcher. Lab users were advised that this was so that the Department of Estates could establish if the digital readings on the fume hoods corresponded with how open the fume hood sashes were so as to ensure that the fume hoods were operating effectively and lab users were advised to ignore the presence of the stickers and the researcher.

Prior to Study 2, however, no such email was sent to lab users. Therefore, it could be interpreted that in Study 1, had the lab users not been advised to ignore the stickers, they may have responded in the same manner to those individuals in Study 2. Consequently, it may be suggested that the cover story was too effective to some extent, and in fact inhibited the behavioural responses of the individuals.

3.11.3.2 Measurement

While the cover story is likely to have inhibited the response to the ruler stickers in Study 1 until the addition of the normative information at T3, the cause of the significant change in Study 2 at this point must also be considered. This is of importance, particularly as the addition of the normative information in Study 2 did not lead to a significant change, instead showing that the blank rulers elicited a maximal behaviour change which could not be improved upon with the addition of normative information. This indicates that the presence of the rulers alone resulted in a substantial change in behavior and, accordingly, in fume hood energy consumption.

It could be interpreted that the inclusion of the ruler allowed lab users to quantify their behavior in relation to fume hood use as this offered a previously unavailable means to quantify behaviour. The placing of the ruler in the cheek of the fume hood provided a measurement tool by which individuals could see in real-time how many centimetres the sash is open. Prior to the addition of the ruler, lab users may not have had an accurate understanding of the extent of the sash opening. This point can be supported through the example of filling a kettle, whereby it is difficult to know how much water is in the kettle without the help of the graduated marking showing the level of water and how many cupfuls are present. The rulers may have acted in a similar manner to help objectively measure behaviour.

3.11.3.3 Injunctive norms activation

The addition of the ruler stickers in the baseline data collection period in Study 1 had a minimal effect on behaviour with regards to fume hood closure, and a significant effect on behaviour in Study 2. It must be noted that all lab users are aware that they should close the fume hood when it is not in use, and this message is reinforced during inductions and through the use of signage in the labs, therefore representing an injunctive norm to some degree. Injunctive norms have been traditionally associated with the morally correct behaviour and widely accepted standards and rules (Kallgren et al., 2000). According to Jacobsen and colleagues (2011) injunctive norms are closely linked with maintaining social approval. In line with the previous points, it could be interpreted that the baseline ruler stickers activated the injunctive norm of closing the fume hood when it is not in use.

The literature on normative influence and the focus theory posit that when the injunctive norm is activated and focal, this is when influence occurs, and this is particularly true in the case of pro-social behaviours (Kallgren et al., 2000). Therefore, the presence of the blank ruler stickers, although not highlighting the descriptive norm and the behaviour of others, may have been sufficient to activate the injunctive norm. The simple cue in the environment in close proximity to the location of the behaviour is likely to have served as a reminder that it is expected that the sash is closed when the fume hood is not in use. It may also be the case that the addition of the normative information at T3 served to maintain this behaviour through highlighting the descriptive norm.

3.11.4 Habit formation / Long-Term Behaviour change

Due to the largely habitual and automatic nature of the working environment it was unknown as to whether a simple descriptive norms intervention would be powerful enough to encourage new habit formation in the absence of a significant situational change (Aarts & Diksterhuis, 2000). Despite the consistency of context and presence of environmental cues which remained constant apart from the mere addition of the intervention sticker, it

could be speculated that new habit formation may have occurred. The previous lack of fume hood closure may be as a result of automaticity which has developed due to repeatedly engaging in the same behaviours as is typical in workplace settings. However, following the post intervention period (T4) in Study 1, and the baseline period (T2) in Study 2, the consistently low VAV levels for the duration of the data collection appears to suggest that closing the fume hoods may now have become the new automatic behaviour. This appears to suggest that the use of a suitable descriptive normative message (Study 1) or injunctive reminder (Study 2), presented in the correct manner, may be sufficient to change behaviour significantly without the necessity for a major situational or contextual change.

Both Feder and colleagues (2012) and Siero and colleagues (1996) found relatively long term behaviour change following the implementation of their laboratory energy saving interventions. Both of these studies used a competition element whereby there were prizes for best performance in order to motivate individuals to change behaviour. Siero and colleagues (1996) have highlighted this aspect as being the potential driver for behaviour change in their study. The current research (both Study 1 and Study 2), however, did not utilise a competition as part of the motivating strategy, nor did it explicitly state to the lab users what the purpose or aim of the interventions were. The benefit of this is that firstly, the study ensured scientific rigour by not introducing any potential confounding factors such as the chance to win a prize for engaging in the desired behaviour. Secondly, the findings here show that behaviour change can occur over a medium and long periods of time in the absence of these incentives. This is particularly relevant as many universities use this strategy to encourage energy saving in the lab, with Harvard University pioneering this method several years ago

The intervention showed that approximately eight months following the implementation of the intervention that the effect was still present in Study 1. Not only does this show that the intervention was more effective than that employed by Feder and colleagues (2011) as the

reduction remained significant at eight months following the intervention, but in line with Lally and colleagues (2010) findings that habits may take over six months to form, this could indicate that the intervention has resulted in new habit formation. Contextual reminders have been shown to have diminishing effectiveness over time (Tobias, 2009), however in this study, it could be suggested that habits may have formed prior to the impact of the stickers wearing off, avoiding the necessity of replacing the stickers with an alternative reminder, which has been suggested by Lally and Gardner (2013) as a strategy to avoid such a situation. A long term follow up of Study 2 would be beneficial to determine if habits have also formed in that case, however due to resource and time constraints this was not possible to achieve in the timeframe of this study.

Conversely, as it is not known as to whether it can be categorically stated that a habit was formed as a result of the intervention, the assumption that this has happened must be considered with caution. A further potential explanation for the long term behaviour change which was seen may be relative to the extent to which lab users behave habitually. It must be considered that the survey data showed that there were no strong habits of closing the fume hoods or otherwise, suggesting that there was no existing habit to break or change. This aligns with the findings in Chapter 5, which showed that normative influence is more effective in situations where habits are weak or non-existent. In such incidences, it is hypothesised that the use of social norms strategies are difficult to penetrate pre-existing strong habitual behaviours. Further, while the SRHI showed that lab users did not report strong habits of closing their fume hoods, future similar research could establish instead if there is a perceived habit of leaving fume hoods open, prior to any intervention. This is important to consider, particularly as Gardner, de Bruijn, and Lally (2011) have found that those who show stronger habitual behaviours are more greatly influenced by these habits than by their intentions.

3.11.5 Summary of normative influence

Despite the absence of any personal incentives such as tangible rewards or financial benefits, the social norms intervention was shown to be effective in the long term in both Study 1 and Study 2. It is interesting to note the unexpected effect in Study 2, as the blank ruler stickers were applied merely as a measurement tool for the researcher to use so as to be able to accurately measure the sash opening heights when collecting the observational data. However, it would appear that they in fact served as an injunctive norm with regard to closing the fume hoods. The current chapter therefore demonstrated that both descriptive social norms and injunctive social norms may be a suitable tool for long term, large scale behaviour change which is both cost effective and has clear and practical behaviour change benefits.

3.11.6 Applications and Future Research

The current study provides useful information in terms of the ability of a social norms intervention to significantly change workplace behaviour, without the need to support this with any personal incentives. On an immediate level, this strategy could be implemented across all universities in the UK which currently have a chemistry department and use fume hoods. This could potentially result in a substantial reduction in energy wastage associated with chemistry research in education facilities. The intervention would require little by way of alteration and could be implemented instantly in other institutions. On a more broad level, this strategy could be applied in other workplaces where there is a necessity to change undesired workplace behaviour which may be habitual or difficult to target due to the manner of work being conducted. Due to the nature of the intervention, this could be easily adapted to induce similar social normative influence in different settings, and targeting differing behaviours.

The findings of this study indicate that it is not necessary to frame an intervention with an environmental message or focus in order to achieve pro-environmental behaviour change.

While many interventions aimed at targeting environmentally harmful behaviour involve an environmental message in order to encourage more desirable behaviours, this is not always effective (Goldstein et al., 2008, for example). In addition, an environmentally framed message will likely only appeal to those individuals who are high in environmental concern and for those who are not concerned about the environment the message will be irrelevant. This study showed that it is possible to use a much broader strategy, avoiding the use of an environmentally framed approach, and yet still achieve significant pro-environmental behaviour change. Again, this strategy can be used to target other environmentally harmful behaviours of individuals who have not responded to environmental messages.

While the data clearly show a significant reduction in both sash height and VAV energy data, from a practical point of view it must also be noted that in each study, these reductions would amount to an annual saving of approximately £30,000 across the building of seventy-two fume cupboards. This equates to an approximate saving of over £400 per fume hood. As universities with large chemistry departments could typically have several hundred fume hoods on their campus, this highlights an area for vast savings from both an environmental and financial perspective, particularly as the effect was found to be long lasting.

The current study did not fully establish whether there was a specific driver of behaviour change in terms of the normative information which was provided. Harvard University may be seen as the gold standard of academic excellence, and Harvard's position as the best performer in terms of fume hood sash height when not in use may have been sufficient to encourage behaviour change. However, it is unclear as to whether the overall information presented drove the behaviour change or if some lab users were influenced more strongly by normative information specific to certain universities. Future research should attempt to explore this in follow up surveys or focus groups, in order to gain a better understanding of the processes at play which result in behaviour change. This may provide some useful

information for future similar normative intervention studies by utilising the most effective influences.

A key point to consider from the findings of this study when attempting to assess the effectiveness of future interventions, is the long term design of this research. Due to the availability of energy data over a long period of time, the analysis of extensive data was possible for Study 1. Had this data only been examined in the short term and data collection ended at the end of the post-intervention phase, it may have been concluded that the intervention was not a success in the long term and that the behaviour had returned immediately after the intervention period. However, as a result of monitoring the behaviour over a longer period of time, it was possible to see that, in fact, the return to behaviour immediately following the intervention was short lived and merely represented a spike, potentially as a result of reactance to the intervention.

3.11.7 Limitations

The study had initially planned to use a control group to ensure that any changes in fume hood behaviour which were found could be attributed to the intervention and were not as a result of confounding factors. As the study only utilised approximately half of the fume cupboards to run the study, the other half had been selected to be used as the control group. However, due to a malfunction in the data system, a complete data set was not available from which it was possible to make an objective and reliable comparison. Therefore, it was decided that the incomplete data which was obtained from other labs which were not participating in the study would not be used, resulting in no control group. Accordingly, the findings should be interpreted with caution to some extent.

However, some precautionary steps were taken to determine if any extraneous factors may have been at play. The researcher spoke with the head of Chemistry Department, the carbon manager and some lab users within the building to determine if any energy saving initiatives or strategies had been implemented during or prior to the study. It was determined that there

had been no initiatives during this period. In order to ensure that there was not a reduction in the number of lab users during the intervention and subsequent period of reduced VAV readings, data were obtained relating to the number of card swipes to access the building prior to the study and during the study. This showed that the number of entries to the building remained relatively constant during that period, apart from the second half of August which is typically a common vacation period for staff and this reduction can be seen from Figure 5. Should future similar research be conducted, it would be advisable to make use of a control group so that a clear and objective comparison can be made which shows if there are similar patterns in the data, or if it can be assumed that any changes are likely to be predominantly as a result of the intervention.

A further limitation which must be addressed relates to the normative intervention which was used. The intervention sticker displayed normative information for several universities with regards to average fume hood sash height when the fume hoods were not in use. However, it is unclear from the findings of the study whether it was necessary to have information from multiple universities or if the same change in behaviour would have been found had the stickers only showed the sash height for Harvard, for example. Similarly, as it could be anticipated that there may exist some level of local rivalry between the University of Bath and the University of Bristol, lab users in the study may have simply aimed to be better than University of Bristol and may not have been influenced by the norms of the other universities. As this was not explored in the survey data, it cannot be stated with certainty what specifically caused the change in behaviour. It may even be the case that simply providing an arbitrary target in terms of sash height would have been a sufficient cause for behaviour change which would not necessitate the presence of normative information.

Therefore future research should attempt to further explore the possible causes of behaviour change, to determine if simply having information about one university is sufficient to influence behaviour, or if it is necessary to include multiple points of normative information

to show that many universities are capable of engaging in the desired behaviour, or indeed if simply providing an indicator of the desired target behaviour would suffice. It is also unclear if certain individuals are more strongly influenced by particular universities than others. Therefore, it would be appropriate to carry out an additional study testing different conditions across labs. This could test the effectiveness of using normative information from multiple universities compared to using just one university, and whether it is more effective to use normative information from an institution which is more local or visible. Furthermore, comparisons with other labs within the same university could be explored, as this would determine if social influence is stronger with closer groups in this setting. Due to uncertainty as to which of these factors may have caused the greatest behavioural influence, it would be appropriate to conduct a qualitative exploration to try to uncover how the intervention actually served to encourage behaviour change in the study. This will be useful in terms of informing future research, as it may be the case that a more simplified version of the intervention used here could be just as effective.

3.12 Conclusion

In conclusion, it is apparent that the descriptive normative information which was displayed in the fume hoods was sufficient to significantly change fume hood closing behaviour when the fume hoods were not in use in Study 1. This effect was still present at the final data collection period eight months following the initial implementation of the study, illustrating that not only was the intervention an effective behaviour change mechanism in the workplace in the absence of incentives, but that this change was long lasting, suggesting the formation of new habits. It could be argued that reactance occurred as a result of the inhibiting effect of the presence of the researcher, as it was shown in Study 2 that there was a more immediate and stable change in behaviour following the implementation of the baseline ruler stickers. This perhaps suggests that providing a mechanism of measurement,

which can also function as an injunctive norm is just as effective as the use of descriptive norms for behaviour change. In both cases, the focus theory of normative conduct is again supported, highlighting the importance of making salient the desired behaviour to achieve change. Future research should attempt to further validate these methods, particularly due to the ease of implementation and potentially high return in terms of both environmental and financial benefits.

Chapter 4: Exploring perceptions of normative behaviours with a focus on the importance of privacy

4.1 Abstract

A multitude of literature from classical studies to recent behaviour change research has shown that individuals are largely influenced by the behaviour of others. Social norms, the common behaviour in a given context, have therefore unsurprisingly been shown to be a largely effective tool for behaviour change across numerous settings and types of behaviour. As social norms are typically applied in social settings, there is both the visibility of the behaviour and the presence of a referent group. This allows behaviour to be easily calibrated through observation and social approval or sanction. However, it is not clear as to whether social norms are effective in private settings, in the absence of these two important factors. As many potentially environmentally harmful behaviours occur in private, it is important to determine the extent to which private norms are misperceived and influence behaviour. The current study aimed to determine the accuracy of perceived norms in private settings. Findings revealed that we are less sure of what is normal in respect to private behaviours, and that this may influence how we behave. These behaviours are rated as being more harmful for the environment than non-private behaviours, and we are more uncomfortable with others knowing how we engage in these behaviours. Future research should aim to correct this gap in knowledge with regards to normal private behaviours.

4.2 Introduction

Exploration of the literature on social norms and behaviour change in Chapter 2 indicated a variety of interesting findings from previous research in terms of normative behaviours, perceptions and misperceptions. The review of the literature has also highlighted the largely successful application of normative interventions across a variety of domains, but with particularly promising results with regard to pro-environmental behaviour change (see Goldstein et al., 2008; Reno et al., 1993; Cialdini, 1993, for example). However, in terms of normative behaviours, there appears to be a gap in the literature concerning the extent of

accurate perceptions, or indeed misperceptions held by individuals with reference to environmentally impactful behaviours. The literature on normative perceptions and misperceptions instead largely focuses on risky behaviour relating to alcohol consumption (for example, Campo et al., 2003) and drug use (for example, Perkins, 1997), but does not appear to focus on environmentally significant behaviour.

In a similar vein, it is also evident that in terms of normative misperceptions, these may come about as a result of a lack of visibility. In order for individuals to accurately calibrate their behaviour based on the actions of others, those behaviours must be visible (Kinzig et al., 2013) and salient (Cialdini et al., 1990). However, many common behaviours are carried out in the absence of a reference group which may lead to individuals relying on intuition or misinformed perceptions in terms of what the common method of behaviour is in these private settings. Importantly for the field of environmental behaviour and sustainability, many potentially consumptive behaviours occur in private contexts (for example, in the home), such as domestic recycling, energy use and various washing behaviours. The manner in which these types of behaviours are engaged in has important implications for the environment. While the individual impact of such behaviours is relatively small, the aggregate of these behaviours can be impactful, when many individuals are separately carrying out the same behaviours (Stern, 2000). Contemporary research has found that the level of engagement in common daily behaviours such as recycling in the home and turning off appliances has reduced in recent years (Rückert-John et al., 2013). As these behaviours have the potential to have a significant impact on the environment in terms of their carbon footprint, it is important to establish whether individuals have accurate representations of how private behaviours are commonly engaged in. In line with the focus theory of normative conduct (Cialdini et al., 1990), it has been shown that making the norm focal is essential in order to influence behaviour, therefore behaviours which are not visible to the general public are unable to create any type of normative social influence.

According to Schultz (1999), motivation in the form of social influence likely leads to numerous pro-environmental behaviours. Therefore, it would appear that many behaviours which are important environmentally, could benefit from individuals having a greater awareness in terms of what the descriptive norm is. Greater awareness can potentially lead to increased engagement in environmentally beneficial behaviours and a reduction in environmentally harmful behaviours. However, despite normative interventions being undeniably successful to a large extent, Larimer and Neighbors (2003) raise the question as to what is the range of behaviours which are likely to be influenced by normative perceptions of others; a question which has not been extensively considered in the literature. Therefore, determining normative perceptions across a variety of behaviours is a necessary first step in order to establish the extent of behavioural perceptions or misperceptions and to determine if indeed the privacy of a behaviours impacts accurate normative perceptions.

4.2.1 Private behaviours

To date, the distinction between private and public behaviours has been given little attention in the literature in terms of behaviour changer, particularly with regard to social norms and their impact. This distinction is important, especially as many consumptive behaviours are engaged in in the private context of the home. As a result of this dearth of literature, there is a lack of clarity with regards to the degree of influence, if any, social norms have on private behaviours or whether the privacy status of a behaviour is of any significance. While it is apparent from an abundance of early classical literature that individuals tend to conform to group norms, it has also been demonstrated that rates of conformity were much lower when responses were not visible to the group (Asch, 1956). This indicates that normative influence is likely to be more effective when both the behaviours, and the referent groups' responses are public (Seligman & Finegan, 1990). They go on to state that in private, behaviours are not typically susceptible to compliance, which, according to Kellman (1974) is one of the key components of influence along with identification and internalisation. Seligman and Finegan (1990) state that it is therefore likely to be more difficult to inform

private behaviours. This may be due to the reduced opportunity for social comparison, as well as the lack of positive feedback for engaging in desirable behaviours in private. They suggest that encouragement from a trusted other, for example a friend or a neighbour, may be a suitable strategy to encourage certain behaviours in private contexts.

Batson and Shaw (1991) discuss the phenomenon of altruism and the concept of whether a behaviour can ever truly be altruistic as in most cases these behaviours serve to satisfy self-interest, at least to some degree. His work on the empathy-altruism hypothesis states that benevolent behaviours can be carried out without there being an underlying benefit for the individual engaging in the behaviour. To that end, it may not be a necessity to have a referent group to encourage engagement in altruistic or environmentally beneficial behaviours, as the knowledge of engaging in a behaviour simply for the benefit it brings without there being any personal betterment is possible according to the theory. Therefore, the private nature of the target behaviours may not actually pose an issue in terms of preventing behaviour change.

In line with the focus theory which has been discussed in Chapter 2, it has been found by Kallgren and colleagues (2000) that in naturally occurring behavioural settings, in the absence of a salient norm, it is unlikely that normative considerations will have any influence on behaviour. Early studies have shown that if individuals believe others do not have access to information about how they behave in private, they will not be truthful about their behaviour in order to present themselves in a desirable manner (Schlenker, 1975). Individuals may choose to ignore norms in situations where they believe the behaviour will not be seen by their peer group (Lapinski & Rimal, 2005). Ewing (2001) provides an example of this whereby an individual may perceive that their referent group engage in recycling, but they will choose not to engage in this behaviour in the home as this will not be visible to the group. With this in mind, it could be assumed that private behaviour change

through the use of social norms may be unlikely or impossible, however this has not been explicitly addressed in the literature previously.

4.2.2 Self-presentation

In the majority of social norms studies, social influence has been shown to be very effective in social contexts, as of course, it is social settings which allow individuals to observe and learn appropriate and normative behaviour from others (e.g. social learning theory, Bandura, 1969). The literature on social norms would suggest that individuals on the whole, are largely concerned about their public appearance and how they represent themselves in a public or social context. It is likely that individuals will be influenced by the group norms in these social settings in order to avoid sanctions and group exclusion (Hornsey et al, 2003). Self-presentation strategies have long been addressed in the literature and include some early concepts such as self-monitoring (Snyder, 1974) or self-consciousness (Fenigstein et al., 1975). Engagement in these strategies are therefore more likely to occur in social contexts in order to fall in line with societal expectations and group norms. As it has been shown that socially desirable behavioural responses such as this are carried out in an attempt to please an audience in a particular environment (Baumeister, 1982), the absence of the audience may remove the perceived necessity to engage in such impression management.

Consequently, it could be considered that in social contexts, descriptive norms, which highlight the behaviour which is widely engaged in or believed to be engaged in, in a given situation (Cialdini et al., 1990), may be appropriate for those behaviours which are visible to others. Individuals are likely to be more responsive in these situations in an attempt to present themselves in a manner which they believe is similar to that of the social group. In private settings, it may be the case that injunctive norms guide behaviour to some extent as individuals may be driven by their internalised and private values, in an attempt to be their ideal self (Baumeister, 1982). Conversely, it is unclear as to what the function of a

descriptive norm is in a private setting and whether this type of normative information has any influential power.

Individuals are more likely to engage in socially desirable behaviours, such as pro-environmental behaviours in contexts which are more public in nature than private, merely as a result of the presence of others, and because norms are more salient (Gabriel, Banse, & Hug, 2007). According to Fisher and Ackermann (1998) perceived social visibility and recognition are factors which are important for engagement in altruistic behaviour. Furthermore, Stern, Dietz, Abel, Guagnano and Kalofs (1999) value belief norm theory also suggests that while engagement in environmental or pro-social behaviours on one hand may be in order to satisfy altruistic tendencies, it may alternatively be for self-serving interests in order to manage the expectations of others.

This would suggest that a social norms intervention would be very useful to reduce environmentally harmful behaviours in common or visible areas, which is promising for the development of interventions aimed at influencing environmentally impactful behaviour. However, not all environmentally harmful behaviours are carried out in public view, and it is likely that there are a number of behaviours which contribute to the carbon footprint which are engaged in in a private context, such as in the household (Hunter, Hatch, & Johnson, 2004). Some private sphere direct environmental behaviours include domestic recycling, energy saving, water reduction and sustainable consumption choices, according to Balžekienė and Telešienė (2017). There is little in the literature to suggest what the effects of social norms are on behaviours carried out in these private settings when they are not visible to others, and whether they possess the same utility as in more public, social contexts where the motive for self-presentation exists. Therefore, as self-presentation strategies are likely to be more relevant to public behaviours, the desire to behave in a socially acceptable or pleasing manner may become obsolete to some extent in private settings, potentially impacting normative influence.

4.2.3 Normative misperceptions

The literature review in Chapter 2 discusses the phenomenon of normative misperceptions, whereby individuals incorrectly perceive the manner in which others engage in particular behaviours. Due to the evidence presented in previous research on misperceptions, it is clear that misperceptions and inaccuracies on the perception of others' behaviour is a topic which should be explored further. This is particularly relevant as it is apparent from a multitude of social influence literature that the behaviour of others influences our own behaviour. Therefore, when individuals have misperceptions of normative behaviours, this can result in inadvertently changing behaviour in line with this inaccurately perceived norm. It is thus important to establish the extent to which normative misperceptions exist, particularly for behaviours which may have negative or harmful consequences.

It would appear to be an obvious assumption that for those behaviours which would be considered private, there would be greater incidences of misperceptions of what is normal, due to this lack of visibility and potentially reduced likelihood of discussion about the manner in which individuals engage in these behaviours. The literature on misperceptions outlines three common categories of misperception, which have been addressed in Chapter 2.

4.2.4 Focus theory

When considering normative influence and its potential efficacy with regard to private behaviours, the focal nature of the behaviour must be taken into account. When attempting to change behaviour through the use of normative cues, it is essential that these cues are salient (Cialdini et al., 1991), in line with the focus theory of normative conduct. Cialdini and colleagues (1990) remind us that while norms are effective behavioural guides, the extent of their influence varies from setting to setting and is principally dependent on the extent to which the norm has been activated or made salient. The authors found that regardless of the respective injunctive or descriptive norm in the natural research setting,

participants responded only in line with the norm which was made focal during each trial. This leads to a problem for behaviours which occur in private settings due to the obvious issue of the lack of saliency in terms of normative behaviour and a descriptive norm, as the norm must be suitably activated before it can direct action (Cialdini et al., 1991).

4.2.5 Discomfort

A further possible issue with targeting private behaviours is the potential preconceived awkwardness or embarrassment associated with actions which are typically engaged in away from the view of others. By the very nature of private behaviours, it is possible that injunctive norms will not have been established due to a lack of discussion about these behaviours. This may be due to feelings of uncertainty or discomfort with regards to sharing information about private behaviours. Wellings, Branigan and Mitchell (2000) describe how the discussion of sensitive or private matters creates a challenge for individuals, particularly with regards to issues or topics which may not be typically deliberated over, ultimately creating feelings of discomfort in anticipation of potential disapproval. According to the authors, discomfort can come about when an individual is required to disclose information related to their behaviours or attitudes which would typically be kept private. Feelings of embarrassment, fear or inadequacy may occur out of concern that their behaviours are different to the group norm (Miller and McFarland, 1987).

Furthermore, Goldstein and colleagues (2008) may have demonstrated this to some extent through their research on towel reuse in hotel rooms. As behaviours relating to washing and hygiene are generally conducted in the absence of others and are not likely to be discussed openly, there may be a sense of uncertainty in terms of what is deemed normal behaviour. The normality of an individual's towel washing frequency in the home may never come under public scrutiny, but in situations such as hotel rooms, this introduces the likelihood that their behaviour will now become known to others. The authors found that hotel users were more prepared to reuse towels when they knew it was common practice than for

environmental reasons. Therefore, making information about private behaviours more widely known may in fact help to reduce any potential discomfort surrounding such actions. Moreover, a study on alcohol and decision making carried out by Schroeder and Prentice (1998) found that when students were informed of the prevalence of normative misperceptions and the concept of pluralistic ignorance, individuals who chose to abstain from alcohol were more comfortable with reporting this in the focus group. The findings of this peer-oriented study indicated that when there was awareness of the overestimation of alcohol consumption, students were happier to be honest about lower levels of alcohol consumption and that this was most effective for those who reported greater fear of negative social evaluation.

Normative influence operates in part due to the potential threat of social sanctions in situations where the group norm is not adhered to (Cialdini, 2007). In the case of private behaviours, the threat of public scrutiny is removed, or at least substantially reduced, offering the individual behavioural freedom to some extent with regard to how they choose to act in private. Early research suggests that individuals are unlikely to question each other in relation to behaviours which are seen as private (Berger & Calabrese, 1975). This could perhaps be as a result of the potential discomfort associated with openly discussing behaviours for which no normative guide was provided. Conversely, public behaviours, although conducted in settings which are susceptible to social inspection and disapproval, also offer the opportunity to observe others, in order to calibrate behaviour and remove the potential for discomfort, having provided surety about what manner of behaviour is acceptable in each circumstance.

The literature on normative misperceptions as outlined above, shows that we may overestimate or underestimate normal behaviour and behavioural frequencies. As a result, it is unsurprising that individuals may feel a certain level of discomfort associated with admitting how they behave with regards to behaviours which are largely engaged in away

from the social scrutiny of others. Therefore, providing saliency with regards to normative behaviours which may be commonly misperceived or indeed lacking in visibility entirely, could potentially remove any discomfort associated with exposure or discussion of these behaviours, thus resulting in a more accurate normative guide for behaviour.

4.2.6 The current study

The current research therefore aims to explore these factors further, as it appears that increased visibility and saliency of particular behaviours may lead to a potentially positive impact on the environment through the correction of normative misperceptions which drive individual's behaviours. The study will explore a variety of common behaviours but will focus predominantly on those which are deemed more private as these would appear to be an obvious area where the saliency of normative actions may be somewhat ambiguous due to being out of view. Normative misperceptions in the literature have thus far largely focussed on undesirable and risky behaviours, but their existence in relation to environmentally significant behaviours has not been drawn on.

Further, we do not have a comprehensive understanding of the settings in which social norms function effectively, as noted by Larimer and Neighbors (2003). It is unclear as to whether descriptive norms have the ability to change behaviour in private settings. Behaviours in private settings are important with regards to their environmental impact and it would therefore appear to be a good starting point from which to explore the degree of normative influence as well as the existence of any possible normative misperceptions. This exploratory research could provide important information which may inform future research with regards to environmental behaviours.

The current research will first conduct a pilot study with an aim to explore the general consensus on a variety of common behaviours with regard to perceptions on three separate constructs. First, they will be asked to rate each of forty-four behaviours as to how private/public they perceive the behaviours to be, so that it can be easily established whether

private behaviours are misperceived in terms of what is normative, and whether this is to a greater extent than more public behaviours. Next, they will be asked to rate each behaviour on how good or bad they perceive them to be for the environment. This will help to establish which behaviours are viewed as environmentally significant, while also establishing the accuracy of norms for these behaviours. Finally, respondents will be asked to state how comfortable or uncomfortable they would be if the manner in which they engage in the listed behaviours was visible to others, as discomfort has been shown in the literature to be a possible cause for a lack of discussion about private behaviours.

Following this pilot study, a main study will be conducted which will present a separate sample of respondents with the same list of behaviours. Participants will be asked to report the frequency which they engage in each of these behaviours, as well as their perception of how others engage in these behaviours, or the norm. The findings of the pilot study will be used to weight each behaviour on each of the three constructs as mentioned above. This will help to establish the extent of normative misperceptions across a range of behaviours, and illustrate if there are any differences in normative accuracy for behaviours rated as being more private, as well as helping to determine if there are certain behaviours which show more closely aligned normative perceptions and self-reported behaviours. This will provide a more comprehensive list of normative perceptions and misperceptions than previous literature which has tended to focus on individual or specific types of behaviours.

4.2.7 Aims and hypotheses

The aims of the current research are to establish the extent to which the privacy or lack of visibility of a behaviour serves to create a barrier in terms of general awareness of what is the norm. This is an important area of focus as many behaviours which are environmentally significant occur in the absence of a referent social group, and this lack of a calibrating factor may result in misperceptions of normative behaviour. Previous literature has shown that misperceptions of behaviours can lead to an increase in undesirable behaviour such as

alcohol consumption and drug use. This potential lack of visibility of private behaviours may also inadvertently result in an increase in environmentally harmful behaviour due to the lack of a normative guideline. Should the current study be able to identify that normative awareness of private behaviours are being hindered by their lack of visibility, then this should lead to a promising area of research focus for future normative intervention studies aimed at reducing environmentally harmful behaviours.

This exploratory research will therefore aim to address a variety of hypotheses in line with the literature and aims outlined above through the combination of findings from both the pilot and main study. The pilot study first aims to explore the research question as to whether it matters if individuals misperceive normative behaviours, and if these behaviours are likely to have an environmental impact. The first experimental hypothesis will also be explored through the pilot study which predicts that individuals will report greater levels of discomfort should their private behaviours be known to others (H1). The subsequent three hypotheses will be tested using the result of both the pilot study and the main study. It is hypothesised that for private behaviours, individuals are generally more uncertain as to what is normal (H2). It is also hypothesised that in private settings, there will be a wider range of responses on average, showing greater levels of variation in the manner in which people behave (H3). The study also predicts, in line with previous literature, that individuals will overestimate the extent to which others engage in environmentally harmful behaviours relative to themselves (H4).

4.3 Study 1 (Pilot study)

4.4 Method

4.4.1 Ethical approval

Approval was granted by the University of Bath Department of Psychology Ethics Committee, Ref: 15-098.

4.4.2 Participants

Participants consisted of 49 individuals (32 women, 15 men and 2 did not state), who voluntarily agreed to take part in an online study. Ages ranged from 18 to 71 ($M=34$, $SD=13.89$). Nationality was again mostly British (29%) and Irish (29%). Participants were also recruited through the online sources and social media and informed consent was given in the same manner as above. Participants were incentivised to take part with the option to be entered into a draw to win vouchers.

4.4.3 Measures

Behaviour scale: A list of 44 common behaviours was presented to respondents which was compiled by the researcher and consisted of various familiar behaviours. Participants were asked to rate each behaviour on a 7-point likert scale on three different constructs; namely how they believed the behaviour impacted on the environment, how private they perceived the behaviour, and how comfortable they would be with others knowing the manner in which they engage in the behaviours. Responses ranged from *'Very bad for the environment'* to *'Very good for the environment'*; *'Totally non-private'* to *'Very private'*; and *'Totally comfortable'* to *'Totally uncomfortable'*. The behaviours listed included a variety of actions, many of which could be perceived as having a direct or indirect impact on the environment, some which could be deemed as private *'how often do you take a shower'*, others public *'how often do you eat in a restaurant'*, and more that described general behaviours *'how often do you play a sport'*.

4.4.4 Procedure

The pilot study was conducted entirely online and participants were recruited through advertising on social media platforms. Participants were asked to confirm that they consented to taking part in the study before being directed to some general demographic questions. Following this, they were presented with the 44-item behaviour list. They were asked to rate the behaviours in terms of how private they perceived them to be. Following this, they were again presented with the same list of behaviours however on this occasion

they were asked to rate the behaviour in terms their perception as to their impact on the environment. Finally, the same set of behaviours were presented which asked respondents to rate the behaviours in terms of how uncomfortable they would be with others knowing the manner in which they engaged in these behaviours. Participants were then debriefed and thanked for their participation.

4.5 Results

In order to address the first research question and hypotheses 1, a correlation analysis was run which explored the relationship between the three constructs of privacy, discomfort and environmental impact of the 44 behaviours. These behaviours are ordered on each construct in Appendices A, B and C. The research question aimed to explore whether private behaviours were important in terms of the environment to establish if normative misperceptions of private behaviours are of any significance in terms of potentially influencing environmentally harmful behaviours. It was found that there was a moderate positive correlation which showed that the more private a behaviour is perceived to be, the worse it is perceived to be for the environment, $r=.343, p=.023$. H1 predicted that the more private a behaviour is, the greater levels of discomfort for individuals should their behaviour be visible to others. Correlation analysis revealed a strong positive correlation supporting this hypothesis, $r=.616, p<.001$. The analysis also revealed that the worse a behaviour is for the environment, the greater levels of perceived discomfort, $r=.636, p<.001$. The results are presented in Table 1 below.

Table 1: Correlation matrix

	1	2	3
1. Privacy	-	.616**	.343*
2. Discomfort	.616**	-	.636**
3. Bad for Environment	.343*	.636**	-

4.6 Study 1 discussion

The pilot study aimed to explore perceptions on a variety of common behaviours with respect to privacy, discomfort and environmental impact. The study found that private behaviours are viewed as being more environmentally harmful than more public behaviours, suggesting that this is an area worthy of future exploration in terms of potential behaviour change strategies. It was also found that the more private a behaviour is, the greater the levels of reported discomfort should these behaviours be made visible to others, supporting the prediction in H1. The rating of each of these behaviours also allowed for an objective ordering of behaviours for each of these constructs to be used in the main study to support further exploration.

4.7 Study 2 (Main study)

4.8 Method

4.8.1 Ethical Approval

Approval was granted by the University of Bath Department of Psychology Ethics Committee, Ref: 15-025.

4.8.2 Participants

Following the removal of incomplete data, 227 individuals (165 women, 58 men and 1 other) completed the study. Participants consisted of predominantly Irish (30%), British (24%) and American (15%) respondents, however thirty-four different nationalities took

part. The majority of participants were in the age groups 18-29 (46%) and 30-44 (31%). Participants were recruited through social media and opportunistic recruitment. Informed consent was given prior to beginning the study by agreeing to take part. Participants were incentivised to take part with the option to be entered into a draw to win vouchers.

4.8.3 Measures

Self-report behaviour scale: A 44-item self-report behaviour scale was presented which consisted of the same list of behaviours as the pilot study. Participants were asked to choose on a 7-point Likert scale the response which most closely described the frequency which they engaged in a number of common behaviours. An eighth option of *not applicable* was also included.

Perceptions of others behaviour scale: This is identical to the measure described above, however participants are asked to choose the option which best represents their perception of the average response of the general population in order to establish a perceived norm.

4.8.4 Procedure

The study was conducted online and was undertaken on a voluntary basis by individuals who had viewed the advertisement on various social networks. After confirming that they consented to take part in the study participants were asked to complete some standard demographical questions along with a series of questionnaires. Following the demographical questions, participants were given a 44-item list of behaviours to which they were asked to respond as to the frequency which they engage in each behaviour.

Upon completion of the self-report questions, participants were presented with the same 44-item behaviour scale as in the beginning of the study, however on this occasion they were asked to indicate what they perceived to be the average response which would be made by the normal population. The self-reported questions and the perception of others questions were intentionally not presented consecutively and were separated by other irrelevant

survey measures to avoid influence. Respondents were then debriefed and thanked for their participation.

4.8.5 Data Treatment

The self-report sample allowed for analysis of differences in behaviours across people, both in terms of their self-reported behaviours and their perceptions of others' behaviours. The ratings scales sample in the pilot study provided an average rating for each of the 44 behaviours on three constructs. However, in order to address some of the aims of the study, it was necessary to combine and analyse data from both the self-report sample and the ratings scales sample. Following checking for differences across people, the data were then transposed in order to check for differences across behaviours. This resulted in each behaviour becoming a new variable which allowed for comparison across behaviours in order to establish if there were any behaviour which showed greater variance or differences between the self-reported responses and the perception of others. This also allowed test for patterns using the ratings scales.

4.9 Results

H2 predicted that individuals are lacking in knowledge about what is normal for private behaviours. In order to address this hypothesis, the privacy rating of the behaviours from the pilot study were used to establish which behaviours were perceived as being more public or private in nature. The perceived normative frequencies for each behaviour were obtained in the main study. The standard deviation of responses on each behaviour was used as a measure of variance (SD Norm), with a higher standard deviation indicative of a greater spread of scores showing variance in responses. When correlated with the privacy rating, it was found that there was a moderate positive correlation (see Table 2), indicating that the more private a behaviour is, the greater the variance in what is perceived as normal, $r=.436$, $p=.003$. This is illustrated graphically in Figure 1 below.

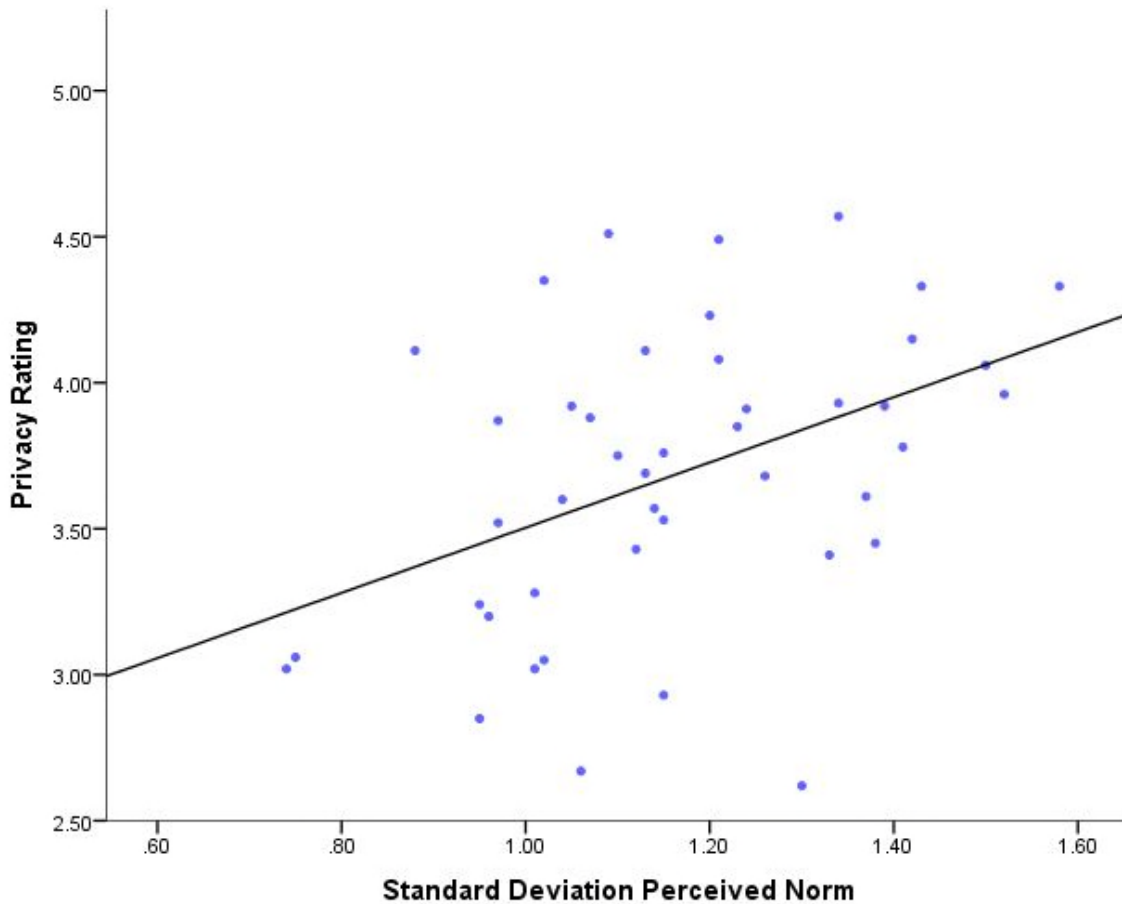


Figure 1: Scatterplot showing correlation between variance in perceived norm and privacy rating of behaviour

H3 predicted that there would also be greater variance in the self-reported responses to each of the behaviours for those behaviours rated as more private. In contrast to the findings of H2, it was found that there was no correlation found between how private a behaviour is and the variation in self-reported behavioural responses, $r=.156$, $p=.313$, (see Table 2). This appears to show that there is no systematic relationship between how private a behaviour is and how variable individuals are in their self-reported behaviour. A scatterplot of this relationship can be seen in Figure 2 below.

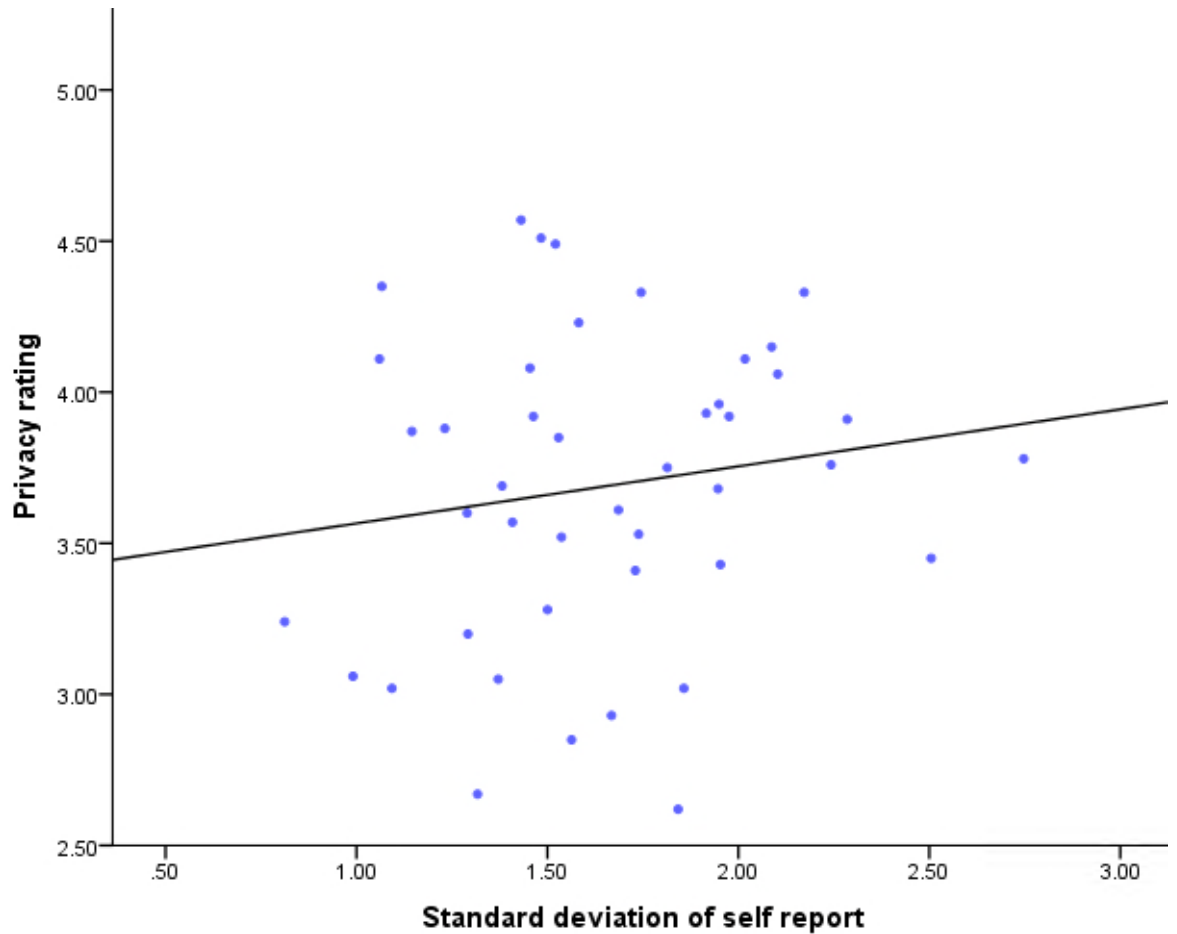


Figure 2: Scatterplot displaying relationship between variance of self-reported behaviour and privacy rating of behaviour

While visually, Figure 2 appears relatively similar to figure 1 in terms of the dispersion, attention must be drawn to the scaling of both figures as the X axis of Figure 2 presents a greater range. For ease of comparison, the correlation presented in Figure 1 is presented below, however, the scale of the figure has been adjusted to correspond with that of Figure 2.

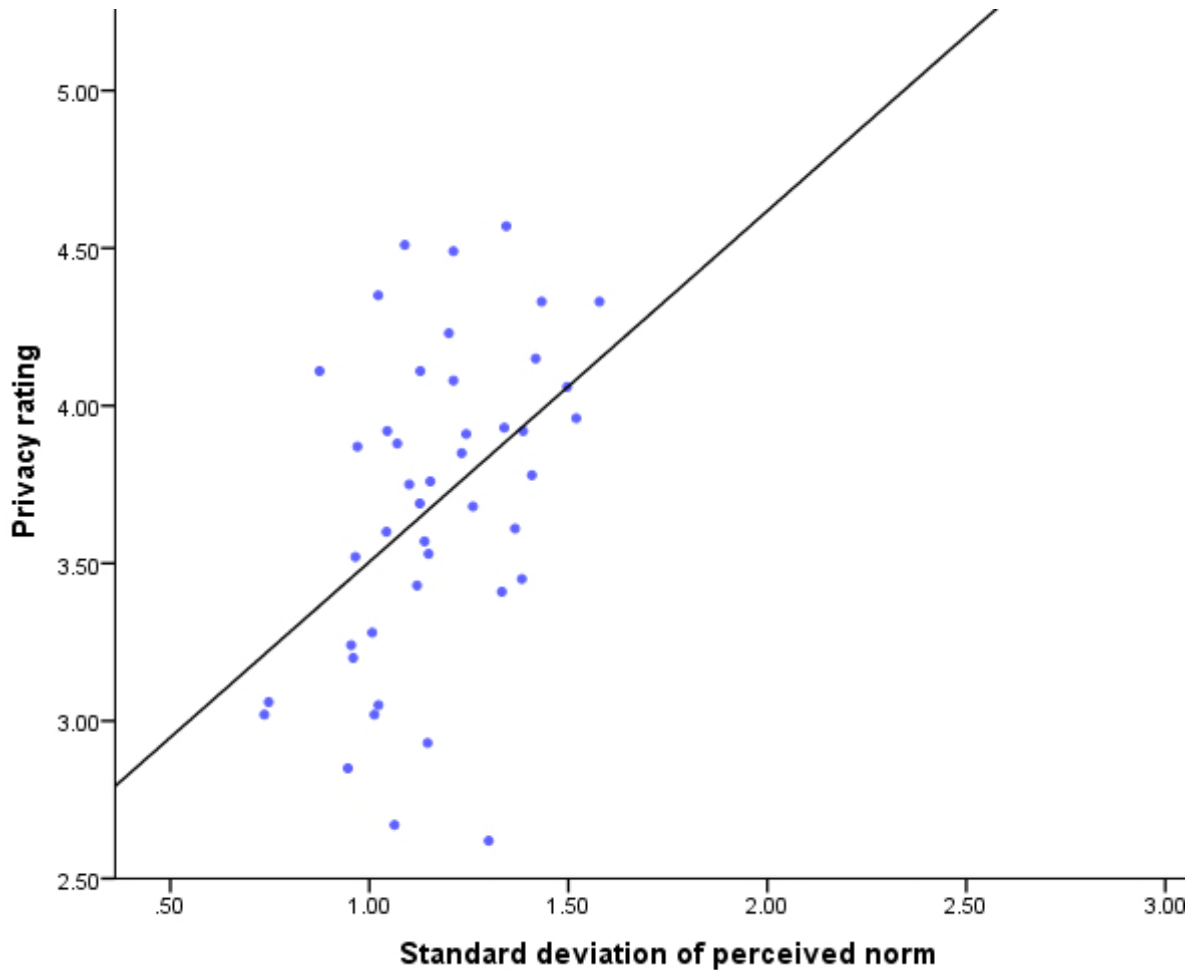


Figure 3: Scatterplot showing correlation between variance in normative perceptions and privacy rating of behaviours, adjusted to scale

Figure 3 shows a much narrower range of dispersion in terms of respondents' perceptions of what is normal, with greater variance in behaviours rated as more private. However, Figure 2 illustrates that there is greater dispersion across behaviours with no apparent relationship between variance and ratings of privacy.

Correlation analysis also revealed a very strong positive correlation between respondents self-reported behaviour and their perception of what is normal for others, which was found to be significant, $r=.838$, $p<.001$.

Table 2: Correlation matrix of variables

	1	2	3	4	5
1. Privacy rating	-	-.055	.009	.156	.436**
2. Self-report	-.055	-	.838**	.124	.403**
3. Norm	.009	.838**	-	-.028	.380*
4. SD Self report	.156	.124	-.028	-	.644**
5. SD Norm	.436**	.403**	.380*	.644**	-

In order to address the final hypothesis (H4), which predicts that individuals will perceive others to be worse than themselves in terms of behaviours which are bad for the environment, a series of steps were taken. Firstly, twenty of the ‘self-report/perception of others’ variables were selected, which consisted of the ten behaviours which were rated as being worst for the environment and the ten behaviours rated as best for the environment, according to the ratings scale sample. These variables were then recoded so that higher scores represented behaviour which was better for the environment. For example, for the variable ‘Do you/others leave lights on at night?’ the response scale was reversed from ‘*1-never ...7-always*’ to ‘*1-always...7-never*’ meaning that higher scores now represented behaviour which is perceived as ‘better’ for the environment. Of the twenty variables which were employed for the analysis, twelve were required to be reverse scored.

Following this step, responses for self-report and normative perception of others were then recoded from -3 to 3 with 0 at the midpoint. Scores from perception of others were then subtracted from the self-report scores in order to determine any discrepancy between respondents’ own behaviours and their view of others’ environmentally ‘good’ behaviour. The mean difference was then calculated, creating a new difference variable which represented the discrepancy in environmentally friendly behaviour. A one sample t-test was used to check for a statistical difference between this discrepancy variable and zero. It was found that the difference in scores on behaviours rated as being ‘good for the environment’

($M=0.333$, $SD=.491$) was statistically greater than zero, $t(226)= 10.223$, $p<.001$. This showed that respondents believe that they engage in behaviours which are good for the environment to a greater extent than others. Conversely, this also supports the prediction that individuals perceive that others engage in environmentally harmful behaviours to a greater extent than they themselves. For illustration purposes, an example of one of the behaviours, namely ‘reusing bags’ is presented below (Figure 4), which shows the difference in responses for the self-report ($M= 5.61$, $SD = 1.371$) versus perception of others ($M = 4.08$, $SD = 1.015$) with regard to this behaviour, which was rated as having a very strong environmental impact by the pilot study sample.

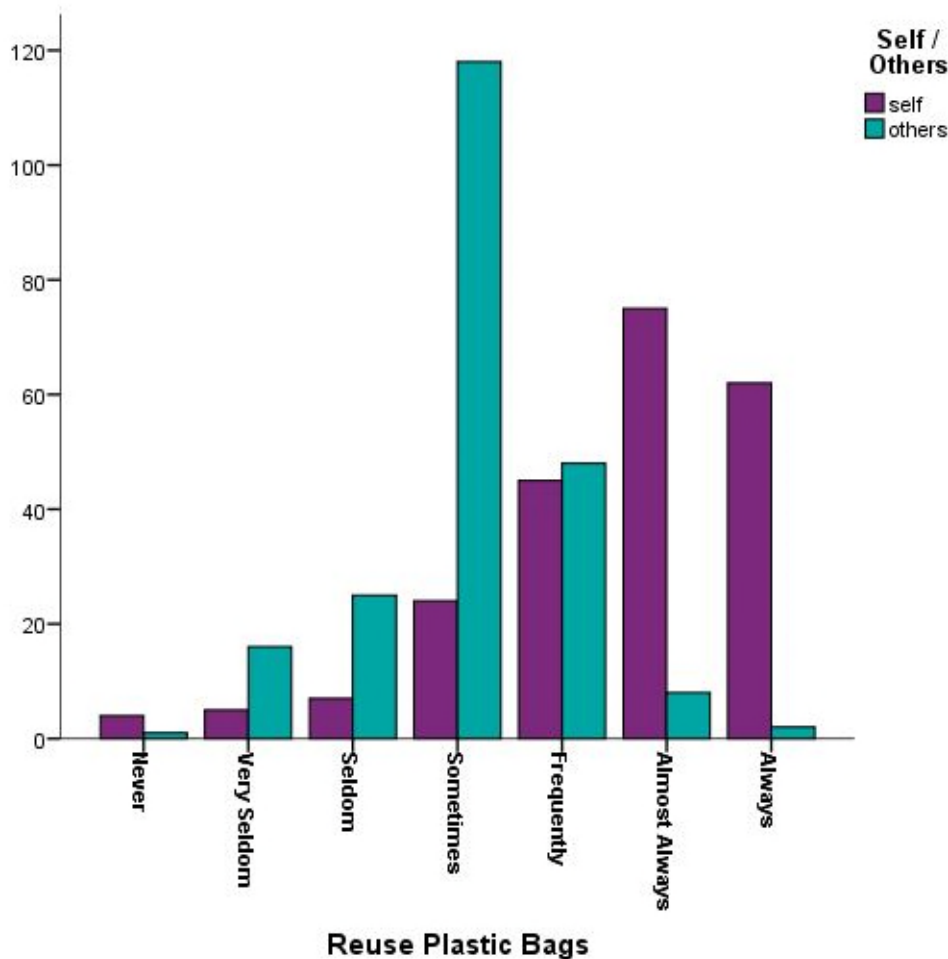


Figure 4: Bar chart illustrating self-report and perception of others engagement in reusing of bags

4.10 Discussion

This current study aimed to examine normative awareness and accuracy across a variety of behaviours with a specific focus on behaviours which are considered to be private in nature. The study broadly aimed to engage in preliminary work to determine the extent to which social norms may be effective, beyond social or group contexts as this is an area which has not been explicitly targeted in previous research. A variety of hypotheses were tested which will be discussed below. The research largely intended to explore social norms and their utility with regards to private behaviours with a particular focus on descriptive norms and whether these are still functional in the absence of a reference group. A pilot study was first conducted which allowed behaviours to be ordered objectively in terms of individuals' perceptions on levels of privacy, discomfort and environmental impact. Following this, the main study was conducted which drew on the findings of the pilot study in order to explore the subsequent hypotheses.

4.10.1 Environmental impact of private behaviours

The pilot study first explored the research question of whether normative misperceptions of private behaviours are of any significance in terms of their environmental impact. The literature to date has not explored the extent to which individuals are aware of, or consider the environmental impact of their private behaviours, perhaps due to a lack of open discussion around these behaviours. Correlation analysis found that on average, respondents rated private behaviours as worse for the environment than more publicly rated behaviours. Therefore, in response to the research question, it can be stated that private behaviours are at least *perceived* as being more harmful for the environment, suggesting that they are a field which warrants further exploration.

It must be noted however, that this finding merely demonstrates respondents' perceptions and these may have been arrived at using various evaluative strategies. From Appendix A, it can be seen that respondents rated 'leaving the lights on' as the most environmentally

harmful behaviour, which indicates a potential lack of accuracy in terms of the environmental impact of daily and potentially routine behaviours. Previous research has shown that individuals demonstrate inaccuracies in terms of understanding energy consumption comparatively across common appliances (Attari, DeKay, Davidson, & De Bruin, 2010). The current findings clearly illustrate that private behaviours are perceived to be significant in terms of their environmental impact and this was shown across the sample. However, it is also apparent that greater awareness may be required so that the general population have suitable evaluative tools to measure how environmentally harmful particular behaviours are for the environment relative to others.

4.10.2 Privacy and Discomfort

The pilot study also addressed the first hypothesis, which predicted that those behaviours which were deemed more private in nature would be associated with greater levels of discomfort should their behaviour be known to others. According to the findings, respondents did report that the more private a behaviour is the more uncomfortable they are with others being made aware of their behaviours, as shown through the strong positive correlation which was found. It is unclear as to the specific cause of this discomfort, although it may simply be due to the finding by Wellings and colleagues (2000) that discussing behaviours which are typically conducted in private settings can result in feelings of discomfort for the individual. Miller and McFarland (1987) also suggest that the discomfort associated with private behaviours may be as a result of the concern that due to the lack of a reference group for behavioural guidance that individuals' private behaviours are not in line with the group norm. This would concur with the literature on pluralistic ignorance, whereby there is a belief that one's private behaviour is different to that of their peers (Miller & McFarland 1991). Prentice and Miller (1993) suggest that this pluralistic ignorance may occur as a result of differences in the manner in which individuals encode the behaviour of themselves and others.

This finding could also suggest the existence of self-presentation to some extent. If individuals present a particular identity of themselves when in their referent group which does not correspond to their private self, this may create a sense of discomfort at the thought of this being exposed. Triandis (1989) suggested that an individual's private behaviour is guided internally by the self, while in public, the presentation of the self will reflect the behaviour of the referent group. A private identity which is in conflict with the social identity may lead to these feelings of discomfort and suggest that individuals may not behave in a manner which is consistent with their visible behaviour. Snyder (1987) also supported this notion of contradictory presentations of the self from private to public settings. Should individuals engage in knowingly conflictive behaviours in this manner, this may explain the reported discomfort associated with behaviours which are typically out of view. It must also be noted that while there was a positive correlation between discomfort and privacy, there was a similar positive correlation shown between perceived discomfort and how harmful a behaviour is for the environment. This may show to some degree that individuals knowingly engage in behaviours which are bad for the environment in private. The relationship between environmental behaviours and discomfort which was found potentially indicates a knowledge that this is in conflict with the injunctive norm.

4.10.2.1 Privacy or Environmental Impact?

This illustrates that the more a behaviour matters environmentally, the more concerned we are about others knowing how we engage in these behaviours. This may be interpreted in various ways. On one hand, this could suggest that people are very concerned about environmentally significant behaviours but are not confident in terms of how to behave 'normally' resulting in the reported discomfort. On the other hand, this might suggest that individuals only engage in environmentally positive behaviours from a social desirability perspective when these behaviours can be viewed by others, whereas behind closed doors, we instead choose to avoid attempting to reduce environmentally harmful behaviours as in the absence of referent others we obtain no social approval.

This finding brings to mind the question of whether a prosocial behaviour is ever truly altruistic. It could be interpreted from the above findings that for those behaviours which matter the most in terms of environmental impact, based on the behaviour ratings in the present study, these are the behaviours which individuals are shown to have high levels of discomfort associated with their behaviours becoming visible. This may suggest an element of normative distress, which as defined by Cialdini (1991), refers to a feeling of discomfort in situations where an individual has violated personal or social codes of practice. It may also suggest that while individuals are willing to engage in environmentally beneficial behaviours in public settings, that their environmentally impactful behaviours away from public view may not be so favourable.

It could also be interpreted that in the case of private, environmentally significant behaviours, that due to the lack of visibility, and therefore guidance on suitable methods of behaviour, this in turn results in the reported feelings of discomfort. The general lack of a reference group to provide social approval or sanction results in individuals relying on other mechanisms in order to guide their behaviour

4.10.3 Accuracy of private norms

Combining the privacy rating of behaviour with the data collected from the main study allowed the second and third hypotheses to be addressed. It was predicted that due to the lack of visibility of private behaviours, there would be greater variance in individuals' perceptions of what is normal private behaviour (H2), and that this variance would also be present for self-reported private behaviours for the same reason (H3). However, while it was found that there was greater variance in respondents' perceptions of the norm for private behaviours in comparison to more publicly rated behaviours, this was not the case for the self-reported behaviours, with no apparent systematic relationship in terms of the privacy level of behaviours. Therefore, hypothesis 2 can be accepted, whereas hypothesis 3 must be rejected.

Ultimately, the findings of the analyses, and as evidenced through Figure 2 and Figure 3, revealed that from one individual to another there is large variance in what respondents say they do, and this is true across all behaviours irrespective of privacy rating. Conversely, when considering the behaviour of others, or the normative perception, respondents showed relatively narrow dispersion in what they believe others do, again, across all behaviours. However, when considering the private behaviour of others, it was found that there was greater variance in responses, in line with the hypothesis prediction. This finding that there is greater uncertainty about what others do in private is unsurprising, particularly due to the lack of knowledge and a focal guide for these behaviours. When individuals are left to their own devices to establish what is normal, various factors may influence how this is determined, therefore it is unsurprising that there was greater dispersion of self-reported responses. Dispersion of self-reported responses for all behaviours were shown to be approximately one standard deviation greater than those of normative perceptions of others. Again, this may indicate an element of pluralistic ignorance as it is evident from the above findings that respondents in the study believe that others engage in private behaviours in a manner which is different to how they report their own behaviours. Miller, Monin and Prentice (2000) draw on the issue of using visible behaviour patterns to make incorrect assumptions about individual's private attitudes and behaviours.

This may suggest that while individuals have beliefs about how others behave, or should behave, in private, this does not influence their own behaviour. It could be interpreted that as individuals know their behaviour is not visible to others, they are not influenced by norms, as suggested by Lapinski and Rimal (2005). Norms function to some degree by way of a threat of social sanction or group exclusion should the normative behaviour not be adhered to (Fehr & Fischbacher, 2004). In the case of private behaviours, there is an awareness that behaviours are not visible to the referent group, and this may justify engagement in behaviours which are not in line with the group norms. This finding could

also be related to the first research questions as well as hypothesis 1, which found that the more private a behaviour is, the worse it is for the environment, and the more private a behaviour is, the greater discomfort associated with it, respectively. There may be discomfort associated with private behaviours as individuals are aware that their behaviour is not in line with what they perceive others do in private, and that these private behaviours are those they believe to be worst for the environment.

4.10.3.1 Implications of private behaviours

Analysis showed a very strong correlation between what individuals say they do and what they perceive others do in the same situations. This is not a novel finding, and very much supports the multitude of literature on social norms and normative influence to date. However, in typical incidences of social influence, there is generally a group element of behavioural guidance which serves to inform the target individual's behaviour. While the behaviour of referent others may have influenced respondents' behaviours which are more public, it is unclear as to what the direction of influence is for those behaviours which are more private. It is therefore unknown as to whether the respondents' beliefs about others private behaviour influenced their own self-reported behaviour, or conversely, if they believe their own behaviour to be the norm, thus influencing their perception of others behaviours.

The implications of these findings are therefore wide ranging. To date, there appears to be a gap in the literature in terms of the impact of the availability of normative information on private behaviours. The findings here indicate that private behaviours may indeed be influenced by normative perceptions, however, these perceptions are highly varied across individuals, which suggests that they are inaccurate and that the privacy of a behaviour may in fact serve as a barrier to knowledge in terms of accurate normative perceptions.

Consequently, this would appear to indicate that for private behaviours, people may have normative misperceptions which are inadvertently influencing their private behaviours in

line with these inaccurate assumptions about others. The literature has shown that in the case of misperceptions of risky or undesirable behaviours, these serve to encourage similar behaviour as a result of pluralistic ignorance, whereby the individual corrects their behaviour in line with what they believe to be normal for referent others (Neighbors, Dillard, Lewis, Bergstrom & Neil, 2006). For example, this was shown in Prentice and Millers (1993) study on alcohol consumption whereby attitudes on drinking were shifted over time to what respondents believed to be the group norm.

However, in the case of the current study, it would instead appear that in terms of their perception of private normative behaviours, the phenomenon of false consensus may be at play. The theory on false consensus bias posits that in certain situations people can greatly overestimate the extent to which their attitudes and behaviours are typical of others and in line with the broad norm (Ross et al., 1977). The strength of the correlation between self-reported and perceived normative behaviour clearly indicates that on the whole, people believe themselves to behave in the same way as their referent others. This finding also goes some way to address the question raised by Larimer and Neighbors (2003) which asked what range of behaviours are influenced by normative perceptions. It is apparent from the findings of the current study that the range of behaviours influenced by normative perceptions can now include private behaviours, where there is no obvious normative guide available.

4.10.4 Overestimation of bad behaviour

Previous research on normative misperceptions has shown that individuals tend to overestimate the extent to which others engage in bad or undesirable behaviours. Hypothesis 4 predicted that, similarly to previous research, in comparison to themselves, respondents would overestimate the extent to which others engage in behaviours which are deemed harmful to the environment. Much of the literature on normative misperceptions indicates that individuals largely overestimate the degree to which their referent others engage in

behaviours such as gambling (Larimer & Neighbors, 2003), alcohol consumption (Borsari & Carey, 2003), and risky sexual behaviours (Lewis, Lee, Patrick, & Fosso, 2007). It would appear that this is no different with regard to environmentally harmful behaviours, with a clear overestimation of the extent to which others engage in such behaviours relative to themselves. While this finding supports previous literature on misperceptions of undesirable behaviours, it is nonetheless surprising that respondents reported greater levels of discomfort with others being aware of these behaviours, particularly as it would appear that respondents believe they engage in environmentally friendly behaviours to a greater extent than others.

This finding could represent false uniqueness, in that respondents appear to underestimate the extent to which others share their positive attributes. To date, it would appear that the literature has not addressed this issue in the context of environmentally harmful behaviours, with the exception of a remark by Bosveld, Koomen, van der Plijt and Plaisier (1995), who stated that those who are environmentally responsible underestimate this quality in others. Rather, much of the research on this topic has focused on personally undesirable behaviour such as those mentioned above, and studies have typically only focussed on singular behaviours. The current study, however, has shown this phenomenon to occur across a range of environmentally significant behaviours, showing that beyond specific, singular behaviours which have previously been explored, overestimation of undesirable behaviour of others can now also be attributed broadly to the field environmental behaviours. This finding therefore expands the previously known selection of behaviours which have been found to be susceptible to misperceptions in this manner to include this range of pertinent behaviours. This again, suggests that greater awareness of norms, and correction of normative misperceptions may have the power to create significant and desirable behaviour change with regard to environmentally impactful actions.

4.10.5 Future recommendations

Both in previous literature on normative influence and the current study it has been established that individuals like to behave in a manner which is similar to referent others. Despite a wealth of literature illustrating the efficacy of social norms on a variety of behaviours, to date there appears to be a gap in terms of what impact the privacy of a behaviour has on individuals' normative perceptions of that behaviour. The current study indicated that private behaviours are an area which warrant further exploration in the field of social norms and normative misperceptions, and that fundamentally, the privacy of a behaviour appears to act as a barrier to knowledge. In order to ensure more accurate knowledge, and to reduce the incidence of normative misperceptions, it would appear that greater transparency is required in order to remove the barrier which currently exists. However, for private behaviours this can be challenging due to the lack of visibility.

In order to address these issues which have been described here, it would appear that a logical solution would be the provision of normative information about private behaviours as this would serve to alleviate each issue.

Therefore, the focus theory of normative conduct (Cialdini et al., 1990) is likely to be relevant even in the case of private behaviours. Making the descriptive norm salient for private behaviours is likely to reduce the discomfort reported by respondents as this would remove any uncertainty about whether their behaviour was normal. This could in turn reduce the incidence of pluralistic ignorance which appears to occur due to the apparent misperception that the general public engage in private behaviours in a manner which is different to respondents. Providing normative information will clarify this inaccuracy and help to guide behaviour as well as highlight that private behaviour may in fact be more closely aligned than respondents assumed, thus reducing variance in perceptions of private behaviours. Schroeder and Prentice (1998) found that peer oriented discussion reduced the level of pluralistic ignorance in the case of drinking behaviours, as this facilitated discussion

about the descriptive norm. Finally, and in line with the previous point, a clearer understanding of the norm will help to reduce the likelihood that individuals believe others engage in 'bad' or environmentally harmful behaviours to a greater extent than themselves. Therefore future research should help to test the assumption that private, environmentally significant behaviours can be calibrated through the provision of normative information.

Future research could also employ a qualitative element to provide a more in-depth understanding of the processes involved when determining how to behave in situations where there may be no explicit behavioural guide. This may provide greater insight into the ways in which individuals choose to behave and if this is indeed driven by perceptions of normality or if there are other processes at play.

4.10.6 Limitations

A key limitation of the study is the use of self-report measures for the main study. While it could be assumed that the questions on normative perceptions were responded to in a truthful manner, it must be considered that there may be some inaccuracies for the self-reported responses relating to respondents own behaviours. Responses may reflect the manner by which individuals believe they should behave to some degree, as a result of response bias or attempts at socially desirable responding. Gatersleben, Steg and Vlek (2002) noted that self-reported responses relating to energy consumptive behaviours may not adequately reflect the true extent of behaviour. However, the anonymous nature of the survey may have reduced the likelihood of this occurring. Further, gathering a comparable level of data using a more objective means of measurement would be time consuming and resource intensive due to the range of behaviour explored.

Due to the diverse range of respondents, it could be suggested that there may be some natural variation in behavioural norms as a result of cultural differences and habits. However, it would appear to be unlikely that this would have unduly influenced the findings which ultimately indicate that private behaviours warrant further exploration in the field of social

norms and normative influence. While particular behaviours may be engaged in somewhat differently across cultures, as a result of the use of a wide range of behaviours in the study it is unlikely that this has impacted on the validity of the findings.

4.11 Conclusion

In conclusion, this exploratory study has shown that private behaviours are an important area which should be given more focus, both in the fields of social norms and environmental behaviour change. The lack of visibility of private behaviours may be considered a barrier to sustainable behaviour in that people have misperceptions about how others engage in these behaviours, which may inadvertently cause greater incidences of environmentally harmful behaviour. Further, it would appear that there may be an element of discomfort in relation to individuals' engagement in private behaviours which should be explored further. Finally, the efficacy of the provision of descriptive normative information relating to private, environmentally significant behaviours should be tested and explored further, as this strategy may allow a wide range of behaviours which have been previously unreachable in terms of normative influence to be targeted easily. As these private behaviours have been identified as being more harmful for the environment than more public behaviours, it is important to find a means to target this area which may result in environmentally positive outcomes, while also addressing an important gap in the literature on social norms theory.

Chapter 5: Evaluating the application of a descriptive norms intervention on the private behavior of showering

5.1 Abstract

Despite the wealth of existing literature which highlights the efficacy of social norms interventions for pro-environmental behaviour change, to date there is a gap in the literature in terms of the application of social norms in private settings. Exploratory research in Chapter 4 indicated that private behaviours are a potentially important target for normative pro-environmental behaviour change strategies. The study found that private behaviours are

perceived as being worse for the environment than more public behaviours and also that individuals are less certain about what is normal behaviour in private settings. A process of private behaviour change was proposed which is tested in the current study. Using the private behaviour of showering, students were provided with bogus descriptive normative feedback on shower duration following baseline data collection using data logging devices. Those who were told they were above the norm significantly increased their shower time, while those that were told they were below the norm reduced shower time, but not significantly.

5.2 Introduction

The literature review in Chapter 2 highlighted the requirement for a suitable intervention which could target environmentally significant behaviour in situations where there is no personal incentive to change. The literature also presented evidence on the efficacy of social norms relative to environmentally significant behaviours, indicating that normative influence may be an appropriate strategy for behaviour change in contexts where there may be little personal benefit to engage in particular behaviours. Exploratory research in Chapter 4 also presented interesting findings which highlight the significance of targeting private behaviours. It was shown that private behaviours are perceived as being worse for the environment than more public behaviours, and also that behaviours which were rated more privately were found to have greater levels of variance, indicating that behaviour is less standardized in these settings. To date, the efficacy of social norms as a behaviour change strategy to specifically target private behaviours has not been explored. The current chapter will therefore attempt to establish if social norms are effective in the absence of a referent social group where there is no personal incentive to change behaviour.

5.2.1 Social norms

Social norms, which describe the common or accepted behaviour in a given context, are a useful tool to guide behaviour as they illustrate to individuals what is expected and accepted in a particular situation. Individuals can calibrate their behaviour by examining the social norm and use it to learn what is socially acceptable in particular situations and settings. As highlighted in the literature review in Chapter 2, it is widely accepted that individuals are generally influenced by the behaviours of referent others. Social norms function by way of demonstrating what behaviour is deemed acceptable and may ultimately impact on group membership (Goette, Huffman, & Meier, 2006). Conversely, behaving in a manner which is counter to the norm could result in sanction from the group (Fehr & Fischbacher, 2004). It is therefore of great importance to the individual to ensure that their behaviour is in line with any prescribed group norm, should they wish to continue to be part of a specific social group in a particular setting.

It is useful to also refer back to the focus theory of normative conduct, as this has demonstrated that the behaviour which is most salient is most likely to influence behaviour (Cialdini et. al, 1990). Ensuring that the desired behaviour is visible or salient, may help to guide the behaviour of others. This may be a suitable strategy which can also reduce the incidences of normative misperceptions, particularly as it was found in the previous chapter that in the case of private behaviours, there were some discrepancies in terms of what people perceived to be 'normal' for these less visible behaviours. Increased visibility will serve to calibrate behaviours and there will likely be less variability across individuals with regard to the manner in which they behave as a result of a focal situational norm. Conversely, more ambiguous behaviours for which there is no salient norm or a behavioural guide may lead to more varied behaviours, as a result of individuals using their own strategies to determine the manner in which they choose to behave. As many behaviours are not necessarily visible

to others, it is not known how individuals calibrate these behaviours or what influences their behaviour choices in these circumstances.

5.2.2 Private behaviours

The issue of private behaviours with regard to their potential impact on the efficacy of normative influence has been outlined previously. Ultimately, it can be assumed that due to the lack of visibility, this may lead to individuals incorrectly believing their behaviour is the same as others. Additionally, individuals may be inadvertently influenced by what they incorrectly perceive to be the norm of the behaviour of others. Due to the nature of private behaviours in particular, it is unclear as to what might drive individuals' behaviour in these contexts, particularly as there are not necessarily social norms attached to private behaviours. It could be suggested that some individuals may be driven by their social group, despite being out of their view. People who are largely influenced by their referent group and engage in impression management or alter their behaviour in line with that of their group can be described as self-monitors, which describes the process where individuals engage in self-observation guided by perceptions of social appropriateness (Snyder, 1974). This phenomenon has been outlined in Chapter 2, along with self-consciousness which states that individuals are either driven internally by values or externally by the views of their social group (Fenigstein et al., 1975). For those individuals who are high in public self-consciousness, who tend to behave in a more socially desirable manner, it is unclear as to how this functions for private behaviours, in the absence of their referent social group.

Typically, one of the key drivers of normative conformity is the attempt to either avoid social sanctions (McKenna, 2000) or to seek approval from the social group (Terry et al., 1999). In the case of private behaviours, the absence of the referent social group to either indicate approval of engagement in the socially accepted behaviour or to provide sanction for engaging in conflicting behaviours, may have an influence on an individual's response

to the norm. Vicarious reinforcement describes how individuals look to similar others to observe the consequences or outcomes of deciding whether to ignore or follow the behaviours of a potential 'model' (Bandura et al., 1963). However, as there is no model to look to in the case of private behaviours this may encourage individuals to employ a different strategy when determining behaviour in a private context. There is therefore a possibility that social norms interventions may be redundant in private settings for these reasons.

It could be assumed that there is a general lack of discussion around private behaviours due to the perceived discomfort of deliberating on potentially sensitive topics (Wellings et al., 2000) which also reduces awareness of how others conduct these behaviours. Therefore, providing a norm about these private behaviours may clarify any potential misperceptions, and ultimately reduce the frequency and variance associated with these behaviours in the case of individuals who may overestimate the normative frequency.

Similarly, it could be expected that providing information to individuals about their behaviour which contradicts their self-perceptions may result in an alteration to behaviour to reduce this discrepancy, as posited by cognitive dissonance theory (Festinger, 1957). Festinger suggests that individuals will seek consistency between cognitions and behaviours and therefore should alter behaviour which is not in line with this. For example, individuals who perceive themselves as being pro-environmental would alter any behaviours which are not in line with this self-perception should that become apparent through the awareness of normative information about environmentally impactful behaviours. According to Mattern and Neighbors (2004), the correction of misperceptions is a key factor in the ability of a normative intervention to influence behaviour, which was found when attempting to reduce drinking behaviours on campus. If normative information about a particular behaviour is not available or salient, people may think that their behaviour is 'better' relative to others

than they in fact are, as this has been found to be true in the case of many undesirable behaviours in line with theory on false uniqueness (Suls and Wan, 1987).

5.2.2.1 Private behaviours and their environmental impact

While it is apparent that individuals are lacking in guiding information relative to what is normal behaviour in private contexts, it was not clear as to whether this was of any significance from an environmental perspective. Chapter 4 explored this question and found that behaviours which were rated as being private, were also rated as being worse for the environment than more publicly rated behaviours. This indicated that private behaviours are indeed an area of importance with regard to their environmental impact and therefore a field for further exploration.

However, despite private behaviours being rated as being worse for the environment, this finding must be interpreted with caution, as these are rated perceptions of negative environmental impact as opposed to actual negative environmental impact. To elaborate, of the 44 common behaviours which were rated by participants, leaving lights on was rated as being the worst for the environment, despite much more environmentally harmful behaviours appearing on the list (for example, leaving heating on all night). Early research on energy literacy found that consumers choose energy reduction strategies which are largely ineffective, which may be due to the manner in which non-experts quantify consumption (Kempton & Montgomery, 1982). Nonetheless, many other behaviours which were rated as being most environmentally harmful were more accurate in terms of impact such as overfilling the kettle, or frequent washing behaviours.

This finding, that private behaviours are viewed as more environmentally harmful and, vice versa, that more public behaviours are viewed as less environmentally harmful might be interpreted in terms of people's desire to present themselves in a favourable light to others, and thus only engaging in pro-environmental behaviours in public settings. Research on impression management has shown that individuals may only engage in altruistic

behaviours for personal reward when they are visible to others. Conspicuous conservation describes the phenomenon whereby individuals engage in pro-environmental acts in public or visible settings can help to build prosocial reputations (Griskevicius, Tybur, & Van den Bergh, 2010). Alternatively, this finding may also indicate the degree to which private behaviours are discussed in terms of their environmental impact, as this may be very minimal if at all, as it was also shown in the previous chapter that individuals reported greatest levels of discomfort as being associated with their private behaviours being visible to others. This again highlights the necessity to provide normative information as these potentially automatic, common household behaviours are unlikely to be openly spoken about in other contexts.

5.2.2.2 Addressing the gap in normative awareness

Therefore, by providing individuals with normative information, specifically descriptive normative information about what referent others do, this could potentially serve to address any gap in individuals' awareness and correct any potential normative misperceptions surrounding private behaviours. It would then be anticipated that this descriptive normative information, in line with previous normative influence research, would influence behaviour towards the provided norm and thus calibrate behaviour in line with the given norm. Private behaviours were found to have greater levels of variability in Chapter 4, and the provision of normative information about these private behaviours may serve to reduce this variance and streamline behaviour. The focus theory of normative conduct (Cialdini et al., 1990) posits that the norm must be salient in order for it to be effective. However, the provision of normative information in the absence of any focal behavioural guide with respect to norms may circumvent the issue of the lack of a visible norm from which to calibrate behaviour. The descriptive norm about these previously 'invisible' behaviours might thus reduce uncertainty and potential discomfort associated with private behaviours, and calibrate behaviour accordingly.

5.2.3 Water use

Due to the issue of population growth, drought risk, climate change, pollution and development, the water industry is coming under increasing pressure to meet the demands of the global population. As resources become less readily available, the water industry now faces a great challenge in terms of managing supply to the expanding population. In recent years the water industry has seen advances in terms of the development of wastewater treatment facilities, infrastructural improvements and process efficiency, however despite this progression from the supply perspective, there is still the issue of demand. While demand forecasting tools are utilised to assist water companies and reduce forecasting uncertainty (Froukh, 2001), this does not reduce the increasing necessity for water supply or the impact on consumption levels.

It is understandable on some level that individuals residing in the UK may not perceive a drought risk as a result of the typically wet climate across most of the country. However, recent research by Water UK (2016) predicts that the UK is likely to face more common, longer droughts than previously forecasted, with the typically drier south east of England facing more severe droughts, while water shortages are also anticipated in the north and west of the country. As a result, measures must be taken to ensure that the level of demand does not create a situation whereby water shortages will become widespread. Water UK recommend the use of improved building standards as well as greater efficiency across the network, but also suggest that on an individual level, the promotion of more efficient use of water in homes will help to stem this issue. To that end, beyond technology and maintenance, it is important to consider domestic water use and consumer behaviour, as well as the potential impact of individual behaviour change in order to reduce domestic water consumption.

Domestic water use, water which is used for both indoor and outdoor household purposes, such as drinking, washing, cooking and cleaning, accounts for a significant portion of all

water use. *At Home with Water* is a recent study conducted by the Energy Saving Trust (2013), which examined the water use of British households. It found that 25% of domestic water use, or 840 billion litres of water, is attributed to showering, with a further 22% associated with toilet use. It is estimated by The Environment Agency (2009) that the average consumption of direct water per person in the UK is approximately 150 litres per day. The associated carbon footprint of domestic water use must also be taken into account, as this is required to heat the water for activities such as washing and showering. The Energy Saving Trusts study found that of the 875kg of carbon which is used to heat water in the home every year, 61% of this occurs in the bathroom, with the remainder associated with kitchen water use. According to research on a student population, showering accounts for 18% of the carbon footprints of students, only second to dining which accounts for 34% (Li, Tan, & Rackes, 2015).

The findings of these surveys and research appear to suggest that targeting domestic water use, with a specific focus on showering behaviours, may have the potential to reduce both water use and its associated carbon footprint. According to the findings of the Energy Saving Trusts study (2013), time spent in the shower varies greatly, with the majority of respondents (45%) stating that they spend between one and five minutes in the shower, with a further 42% reporting they spend on average six to ten minutes showering. However, as these figures were gathered through self-report measures it is likely that there may be some inaccuracies in reporting. Exploratory findings from Chapter 4 showed that individuals self-report that they spend on average between 10 and 15 minutes in the shower, and this is what they believe is the normative average also.

5.2.3.1 Previous norms research related to showering

An exhaustive search of the literature has revealed that the research on showering and behaviour change is sparse. Aronson and O’Leary (1982) conducted a study which used modelling of appropriate behaviour to promote water conservation in locker-room showers

of a sports facility, whereby a stooge was used to demonstrate the desirable behaviour. However, while their study targeted the behaviour of showering, the aim of the research appeared to be more focused on the conservation of the associated energy use as opposed to water use specifically.

Kurz, Donaghue and Walker (2005) also used a normative component in their study which was aimed at reducing energy and water consumption in a local community, however this intervention was described as socially comparative feedback by the author, as opposed to a social norms intervention. In their social comparative feedback condition, participants were informed of their performance relative to similar households via feedback sheets which were mailed to them biweekly. However, the study found that there was no effect on water or energy consumption for this condition. The authors did however highlight the possible issue of the private nature of the behaviours and the feedback as potentially being confounding factors in the study.

Despite these studies using information about how others behave in an attempt to influence the behaviour of the target individuals, in both studies the strategy was defined as something other than a social norms intervention. This would appear to suggest that there may be no existing study which explicitly uses an applied descriptive normative intervention to influence shower duration. This is therefore an area for further exploration due to the relative ease with which a social norms intervention can be implemented, as well as the potential environmental benefits of a study which can target shower duration.

The use of prompts is discussed by Kurz and colleagues (2005), in terms of their utility with regard to attuning target individuals to the environmental impact affordance of their behaviours, for example. Aaronson and O'Leary (1982) provide the examples of adoption to new farming practices and uptake of shopping trolley use to illustrate their point that demonstrations of behaviour are more effective for behaviour change than the use of information campaigns and prompts. In the case of showering specifically, the researchers

found that the use of prompts with regard to the environmental impact of shower duration was ineffective with respect to behaviour change.

Jorgensen, Graymore and O'Toole (2009) discuss the necessity of trust in order for efficient water consumption to occur. They posit that individuals must trust that others are engaging in water saving behaviours and if they believe that this is not the case then they are less likely to make attempts to conserve water themselves. Rousseau, Sitkin, Burt and Camerer (1998) discuss trust and the various definitions which are presented and highlight the prevalence of the importance of positive expectations about others, in terms of its ability to encourage behavioural cooperation. To consider this with the behaviour of showering in mind, it would therefore be important that individuals were made aware that others are engaging in favourable showering behaviour such as short showers, as to highlight that their referent group is not making the effort, this may also dissuade the target individual.

Dickerson, Thibodeau, Aronson and Miller (1992) used a dissonance arousing manipulation in order to determine if highlighting discrepancies in individuals' actual behaviours and beliefs could influence water conservation behaviour. It was found that when individuals were reminded of the lengths of their showers after urging others to make a public commitment to taking shorter showers, this resulted in a decrease in shower time. To that end, while individuals may hold the belief that they take short showers or, at least, consider themselves to be environmentally concerned individuals, providing them with information about their own showering behaviour may result in a change in behaviour in order to correct this dissonance in a similar manner to Dickerson and colleagues (1992) study. Further, recent research has shown that environmental concern results in greater levels of domestic pro-environmental behaviour (Hall & Allan, 2014).

5.2.4 Habitual behaviours

Another important factor which must be considered here is the effect of habitual behaviours, as they may impact the extent to which providing normative information might change behaviour. Behaviours which are habitual in nature and which are ingrained in the daily routine are likely to be difficult to change (Webb & Sheeran, 2006), and many habitual behaviours have environmentally significant consequences (Kurz, Gardner, Verplanken, & Abraham, 2015). In recent years, showering has become not only a normal, habitual daily activity, but also a daily necessity (Hand, Shove, & Southerton, 2005). The normalisation of the daily shower routine means that this is a behaviour that could be viewed as an almost automatic act due to the habitual manner by which this activity occurs. As the act of showering has transformed from an infrequent luxury to a daily essential, breaking such a ritual or habit might be difficult to achieve, particularly as showering tends to take place in the same location and time each day. Kurz and colleagues (2015) posit that habitual behaviours such as showering may be immune to interventions targeting behavior change due to the automatic nature of this behaviour.

Furthermore, according to Jorgensen and colleagues (2009), outdoor water use is thought to be more discretionary compared to indoor and is therefore more likely to be targeted by regulations. This would suggest that indoor water use, such as those related to washing, cleaning and cooking are more rigid in terms of consumer behaviour and possibly associated with more habitual and automatic routine behaviours. This again poses a difficulty with regard to behavior change, particularly in the absence of a sufficient contextual change. Research has shown that it is difficult to change habitual behaviours when context consistency exists, as cues in the environment serve to promote the original behavior (Lally, van Jaarsveld, Potts, & Wardle, 2010).

5.2.5 The current study

The current study assumes that there is some level of heterogeneity associated with private behaviours due to the lack of normative information to guide and calibrate behaviours. The study aims to increase the homogeneity of private behaviours through the provision of descriptive normative information, which will illustrate the manner in which others engage in the private behaviour of showering, thus reducing its private nature to some extent. Providing a descriptive norm will also help to alleviate any possible misperceptions which may exist as a result of this gap in knowledge. The use of descriptive norms is deemed to be more beneficial than injunctive norms, as this will inform people of what the actual behavior of others is, as opposed to telling people how they should behave, as it is likely that this is already known.

The behaviour of showering, specifically shower duration, will be the target behaviour used for this study for a number of reasons. Firstly, showering is a behaviour which appears to be influenced by perceived norms according to the findings of Chapter 4. Secondly, the previous chapter found that individuals are uncertain in their perception of what a normal shower time is, which could be seen through the variance in responses when asked what they believed to be the normal shower time. Thirdly, showering is a private behaviour, and was rated as being in the top quartile of behaviours in terms of perceived privacy in the same study. Fourthly, showering is a flexible behaviour in terms of an individual's ability to change it. For example, behaviours such as clothes washing can be limited as a result of fixed time cycles on washing machines, whereas shower duration is more malleable in that it has the potential for movement both up and down relatively easily. Finally, as showering is a behaviour which is engaged in extensively across the world, impacting this behaviour has the potential to make significant savings in water consumption on a daily basis. Abrahamse, Guan and Sussman (2015) have recently raised the question of how it might be possible to reduce the water consumption of students as this is an issue which many

universities struggle to address suitably. This indicates that attempts at targeting on-campus residential water use are likely to be useful in terms of future application.

A bogus descriptive norm will be provided to participants who will be randomly allocated into either the 'above average' or 'below average' condition, irrespective of their actual shower duration. Previous literature on normative interventions has shown that providing information to people who are performing better than the norm may lead to a boomerang effect which sees an increase in the undesired behaviour (Schultz et al., 2007). With this in mind it would appear that providing normative information to the 'below average' group might seem redundant, however as the purpose of the study is to establish if a social norms intervention is effective in a private setting it is important to test this bi-directionally. Following objective baseline shower duration measurement through the use of a custom-made data logging device, participants will be informed that their average shower duration is x number of minutes above or below the average of their peers. Further shower data will be collected following the provision of this information before participants are asked to complete a number of survey measures, including questions on perceptions of their own and others showering behaviour, habit, environmental concern, self-monitoring and self-consciousness.

A number of steps have been taken to ensure that the study demonstrates suitable scientific rigor. Feedback about participants shower time will be fabricated with the use of a random number generator, and participants will not be made aware of their own shower time. Participants will also be randomly allocated to the above or below average conditions. This is to ensure that the findings will not reflect inflated results, as those that are genuinely taking much longer showers than others will have a greater capacity for water savings. Similarly, those who take very short showers are likely to have greater capacity to increase shower duration. Thereby, by randomizing the group allocation, this propensity to change will be reduced. Finally, the true purpose of the study was not revealed to participants nor

was the information provided framed in an environmental manner. This is to ensure that any changes in behaviour are not as a result of environmental concern or attitudes which may encourage individuals to reduce water consumption. This will serve to increase confidence that any potential changes in behaviour which are found are as a result of the normative intervention alone.

It is hypothesized that by providing individuals with normative information about the private behaviour of showering, this will serve to reduce the uncertainty about what is 'normal' showering duration, resulting in a shower duration of both groups gravitating towards each other. It is also predicted that as there will be no contextual or situational change as part of the intervention, people in high habitual states are less likely to change their showering behaviour following the provision of the descriptive norms information.

5.3. Method

5.3.1 Ethical approval

Ethical approval was granted by the University of Bath Department of Psychology Ethics Committee, Ref: 15-012

5.3.2 Participants

Participants were 90 first year students at the University of Bath who responded to an email from the University Accommodation Services. Following the removal of participants with incomplete surveys (7 participants) and those who had not correctly participated in the data collection phase (7 participants), and the removal of one outlier due to abnormally long shower duration, 75 participants remained. A post-hoc sensitivity analysis was conducted which indicated that there was sufficient power. Participants consisted of 44 male and 31 female students. All participants were aged from 18 to 20 years ($M = 18.71$, $SD = .632$). Participation was encouraged through the incentive of a prize draw.

5.3.3 Materials and Measures

5.3.3.1 Materials

Data logging device: A data logging device was designed and made by the researchers as an objective method of measuring actual shower time in order to avoid self-reporting methods and associated potential accuracy implications. The device was run using an Arduino board onto which operating code was written. The device was battery powered and was housed in a waterproof plastic casing. Each data logger had 6 buttons on the exterior, and next to each button was an LED light. Beside each button was the name of a participant, with a maximum of six participants to one device. The device functioned when a participant pressed the button which corresponded to their name when entering the shower. When the button was pressed the LED illuminated to indicate that the device was operating. When the participant was finished in the shower they again pressed their button and the LED turned off. The device then stored the shower duration data to a memory card in the device. There was no information displayed on the device pertaining to shower duration at any time, nor was information relating to other participants visible. See Figure 1 below.



(a)



(b)

Figure 1a-b: Data logging device (a) and fixed in place in shower room (b)

5.3.3.2 Survey Measures

The Self-Monitoring Scale (SMS: Snyder, 1974) measures the extent to which an individual consciously engages in impression management tactics in public or social situations. The extent to which an individual employs non-verbal expressive self-presentation is measured using 25 items. The original true/false response scale has been adapted to a seven point Likert scale which asked participants to state the level of agreement they had with each of the statements from 1- *Strongly agree* to 7- *Strongly disagree*.

The Self-Conscious Scale (SCS-R: Scheier & Carver, 2013) measures three constructs, namely private self-consciousness, public self-consciousness and social anxiety. Private self-consciousness in this context refers to the tendency of an individual to introspect and focus on feelings and the inner self. Public self-consciousness relates to being aware of the self in terms of how it is seen by others. Participants were asked to rate on a four point Likert scale the extent to which each of the 22 statements described themselves. The scale ranged from 0 - *not like me at all* to 3 - *a lot like me*.

The Self-Report Habit Index (SRHI: Verplanken & Orbell, 2003) was employed which measures the extent to which a given behaviour is engaged in habitually and frequently. The given behaviour in this study was '*ensuring I do not spend too long in the shower*'. Participants were asked to respond on a seven point Likert scale the extent to which they agreed with each of twelve statements relating to this behaviour. The scale ranged from 1 - *Strongly agree* to 7 - *Strongly disagree*. Higher scores indicated greater levels of habitual engagement in the behaviour.

The revised New Ecological Paradigm (NEP: Dunlap, Van Liere, Mertig & Jones, 2000) was used to measure environmental concern. Participants were asked to rate their level of agreement with fifteen statements on a five point Likert scale. The scale ranged from 1 - *Strongly disagree* to 5 - *Strongly agree*. Following reverse scoring of all even numbered items, higher scores indicated a more pro-ecological view.

The questionnaire also included questions on respondents' perceptions of both their average shower time and the average shower time of their peers, as well as what they believed to be acceptable showering behaviour, in order to gather information on perceived norms and accuracy of these perceptions.

5.3.4 Procedure

Ninety students signed up to participate in the study following an email which was sent by the University Accommodation Services to first year students living on campus. The email was sent out to individuals living in a particular section of the university accommodation as the layout of these buildings was more appropriate for the running of the study. Accommodation with shared bathroom facilities was targeted as this allowed the researcher to maximise the use of the devices.

It was important that the students were not aware of the true purpose of the study and therefore a cover story was fabricated. Students were asked to take part in a study aimed at assessing on average how much water is consumed through showering so as to better manage the supply of hot water for the University (see Figure 2). They were informed that they would be asked to record shower time using devices and that there would be some questionnaires at the end of the shower data collection.



Figure 2: Flyer which was used to advertise the study to participants

Data logging devices were fixed in the accommodation by the researcher. These were placed in prominent positions in the shower room on the exterior of the shower cubicle. A sign was placed next to the device asking that it not be tampered with and it also gave the details of the researcher should there be any queries or issues relating to its presence in the shower areas (see Figure 3). Students were asked to push the button corresponding to their name both as they entered the shower and when they exited the shower. Baseline data was collected for two weeks.

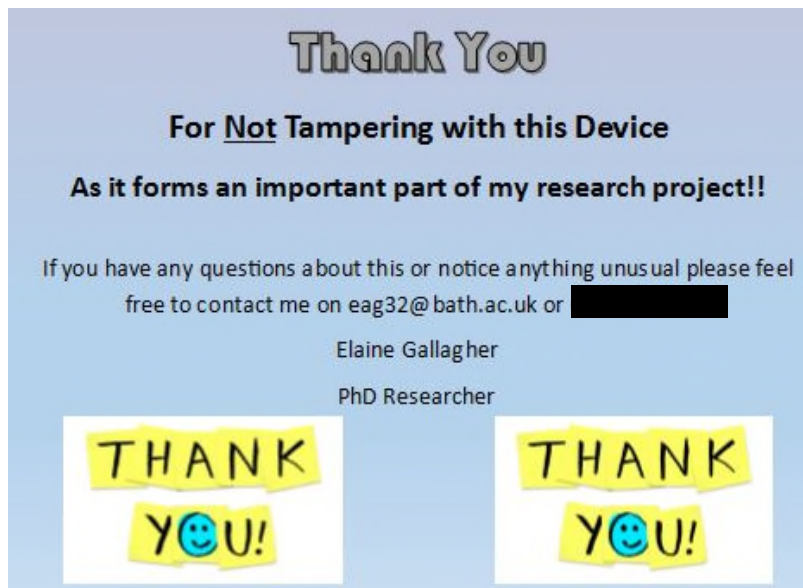


Figure 3: Thank you poster placed in shower rooms next to data logging device

Following baseline data collection, each participant was randomly assigned to either the ‘above average’ or ‘below average’ condition. This allocation was made irrespective of the participants actual shower time. Participants received an email thanking them for their continued participation in the research and they were given details of their individual data in an impartial manner which did not allude to positive or negative behaviour. Those in the ‘above average’ condition were informed that they took longer on average than their peers who were taking part while those in the ‘below average’ condition were informed that they took less time on average than their peers that were participating in the research. Due to the truly random allocation of participants, this resulted in an uneven distribution into the two conditions, with a greater number of students being assigned to the below average condition, i.e., more students were informed that they were taking shorter showers than their peers, on average. Using a random number generator, participants were told they were ‘X’ minutes above or below average, irrespective of their true shower time. This information was provided by email (see Figure 4). For example, a participant may have had on average 10 minute showers and be told they are 5 minutes below the norm, while another participant may have also had 10 minute showers on average but be told that they were 3 minutes longer than the norm. The purpose of this was to ensure that any change in behaviour could be

attributed to the normative information and not due to the fact that a participant had room to increase or decrease. Normative feedback which was given to the participants ranged from 8.5 minutes below the norm to 10.8 minutes above the norm. A common sense check was carried out in order to ensure that the feedback which was given was possible and realistic based on the baseline shower time of each participant. In situations where the random number generator selected a number which was unrealistic, for example, if an individual with a baseline average of 5 minutes was told they take six minutes longer than their peers, this number was skipped and the next realistic number was chosen.

Hi (insert name),

Thank you for continuing to take part in the shower monitoring study. We are now halfway through the data collection. For your information, on average, your shower uses 56.09 litres more than the overall average of the participants in this research, which equates to approximately 7.1 minutes more per shower.

Please continue to use the shower monitor for the next 2 weeks if possible. I will send a link to some surveys next week which I would appreciate if you could complete and you will then be entered into the prize draw!!

Thank you ☺

Elaine Gallagher
PhD Researcher |

Figure 4: Sample email to participants with normative feedback

Following the completion of the shower data collection phases, participants were thanked for their participation and asked to complete the online survey. The survey measures were intentionally given to the participants after the data collection so as to avoid any potential influence on their shower behaviour as a result of reading the topic of the questions therein. Students were debriefed at the end of the survey.

5.4. Results

5.4.1 Survey data

Participants were shown to be high in environmental concern with a mean score of 54.18 (SD=7.24). When NEP scores were compared for the two conditions, it was found that there

was no significant difference, with a score of 54.19 on the NEP in both the above average (participants told they take longer showers than their peers) condition ($SD=7.36$) and the below average (participants told they take shorter showers than their peers) condition ($SD=7.24$), $p=.999$.

Participants also scored moderately high to high on the SRHI which related to ‘consciously taking short showers’ with an overall mean score of 47.69 ($SD=16.45$). However, the above average condition scored higher ($M=52.77$, $SD=16.97$) than the below average condition ($M=44.02$, $SD=15.22$).

A correlation matrix is presented in Table 1 below which included the four survey measures.

The correlation analyses show that there was a mild negative correlation between scores on the SHRI and scores on the NEP. This suggests that the more habitually individuals engage in consciously taking shorter showers, the less environmentally concerned they are. The SMS did not correlate significantly with any other measure. Private SCS scores were moderately positively correlated with the Public SCS scores ($r=.506^*$, $p<.001$). This suggests that the greater the tendency to introspect and examine the inner self and feelings, the greater the awareness of how oneself is viewed by others. Private SCS scores were also mildly correlated with scores on the NEP ($r=.252$, $p=.029$), suggesting that greater levels of environmental concern are associated with greater levels of private self-consciousness.

Table 1: Correlation matrix illustrating survey measures

	1	2	3	4	5	6
1. SRHI	-	-.239*	.129	.021	.073	.147
2. Total NEP	-.239*	-	-.086	.252*	.027	.120
3. Total SMS	.129	-.086	-	.098	.103	.072
4. Private SCS	.021	.252*	.098	-	.506*	.782**
5. Public SCS	.073	.027	.103	.506*	-	.822**
6. Total SCS	.147	.120	.072	.782**	.822**	-

A paired samples t-test was conducted in order to determine whether participants self-reported perceived shower duration was significantly different to their actual shower time. It was found that participants actual shower duration ($M=10.75$, $SD=3.9$) was significantly lower than their perceived shower duration ($M=12.63$, $SD=5.96$), $t(71)=-3.187$, $p=.002$, and their perceived shower duration of their peers ($M=12.36$, $SD=4.82$), $t(74)=-2.455$, $p=.016$. A correlation analysis was conducted to establish whether there was a relationship between participants perceived shower time and their perception of their peers shower time. It was found that there was a strong positive correlation, $r=.682$, $p<.001$. However, there was no correlation between actual shower duration and perception of others students' shower duration, $r=.215$, $p=.064$.

5.4.2 Shower data

Objective shower duration data were obtained for each participant through the use of the data logging devices. Across the sample, the daily average number of showers taken was 0.56 ($SD=0.28$). Most participants either had zero or one shower per day, however, there were days when some had two or three showers per day, although this was uncommon. Shower duration information was gathered using averaged individual shower duration as

opposed to cumulative shower time per day (for those who took more or less than one shower daily).

It was found that women took less daily showers ($M=0.47$, $SD=0.24$) than men ($M=0.63$, $SD=0.28$), $t(73)=2.5$, $p<.02$. Women were also found to take longer showers at the baseline data collection period ($M=11.97$, $SD=4.05$) than men ($M=9.99$, $SD=3.52$), $t(73)=-2.26$, $p<.03$. For the data collection period following the normative intervention, there were no significant sex differences in shower duration.

A two-way repeated measures analysis of variance was conducted to explore the impact of normative feedback on shower time (duration in minutes) from Time 1 to Time 2, having been assigned to either the 'above average' or 'below average' condition. There was no main effect for time $F(1, 73) = .067$, $p = .798$. There was a statistically significant interaction effect between time point and above/below average feedback conditions $F(1, 73) = 5.396$, $p = .023$. This effect size was medium (partial eta squared = 0.69).

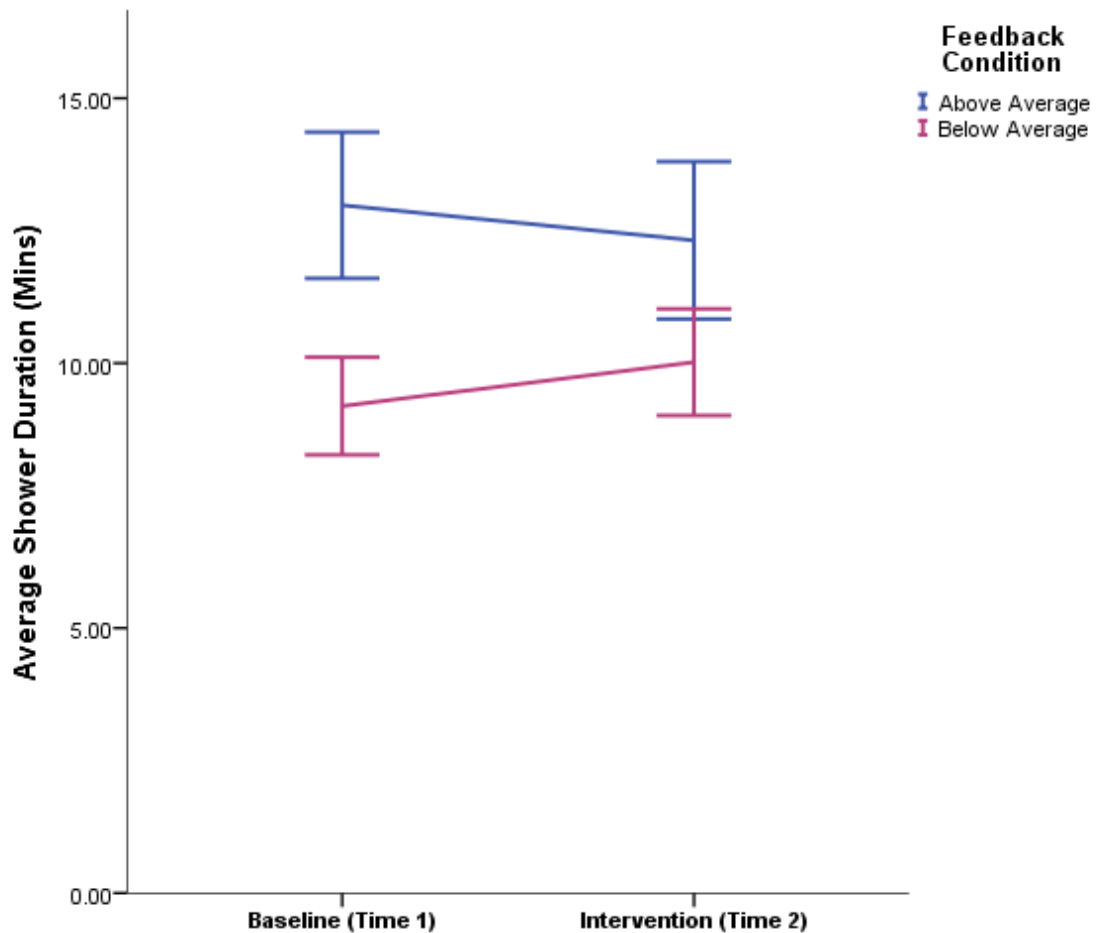


Figure 5: Line graph showing the interaction from Time 1 to Time 2 for the above average and below average conditions with error bars denoting 95% confidence interval

The line graph (see Figure 5) showed a clear trend in the data in that for both conditions shower duration regressed towards the normative feedback provided. A repeated measure ANOVA was run which found a significant interaction effect of time*intervention, Wilks Lambda =.931, $F(1,3) = 5.396$, $p=.023$, partial eta squared =.069. The main effect of time was not found to be significant, Wilks Lambda = .999, $F(1,73) = .066$, $p=.798$. However, the between subjects main effect of intervention (above or below average feedback) was significant, $F(1,73)=16.205$, $p<.001$, partial eta squared=.182. A paired samples t-test was conducted which indicated that while for the 'below average' condition there was a statistically significant increase in shower duration from time 1 ($M = 9.19$, $SD = 3.00$) to time 2 ($M = 10.02$, $SD = 3.27$), $t(42) = -2.54$, $p = .015$, the change in shower duration for the 'above average' condition was not statistically significant from time 1 ($M = 12.98$, $SD = 3.87$) to time 2 ($M = 12.31$, $SD = 4.12$), $t(31) = 1.10$, $p = 0.279$.

Due to the random allocation of participants to conditions, this resulted in a naturally occurring difference in baseline mean shower times between the two conditions. In order to illustrate the change in shower time in a more relative manner, the data were normalized and are presented in Figure 6 below. This indicates the change from baseline to intervention using a common starting point.

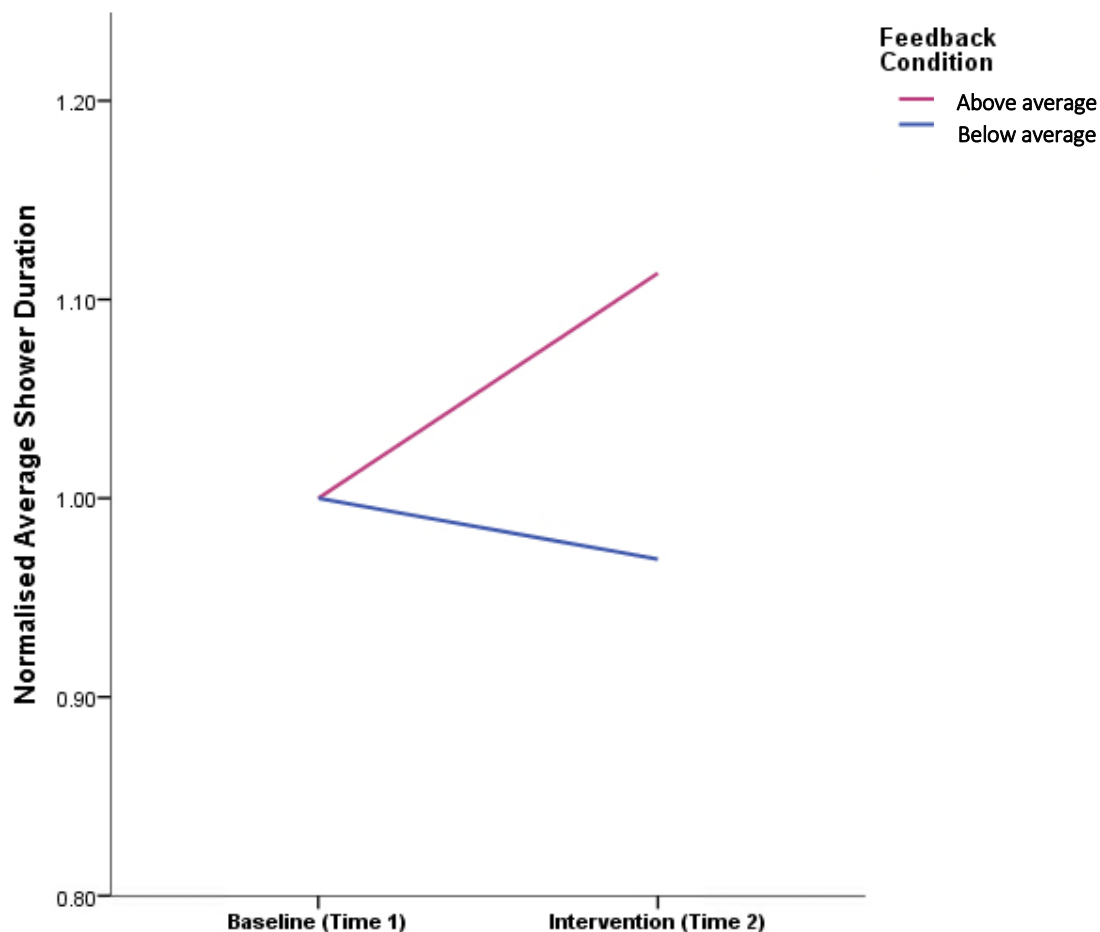


Figure 6: Normalized line graph showing change in shower duration across time points for both conditions

A multiple regression was conducted in order to establish if the four variables chosen (NEP, SMS, SRHI and the SCS) could predict change in shower behaviour. Prior to running the regression, a new variable was created to be used as the dependent variable. This new variable included the direction of the change in shower time relative to the feedback the participant was given. This variable therefore denoted the change in the desired direction with a positive figure for a change in the desired direction and a negative number for a change in the opposite direction. For example, if the participant was told they take shorter

showers than average and they subsequently increased their shower time following the intervention, the value recorded in the variable was positive, whereas if they had reduced shower time despite being told they were taking shorter showers than average the value recorded was negative.

Preliminary analysis confirmed no violation of assumptions of normality, linearity, multicollinearity and homoscedasticity. The model explained just 4.7% of the variance, however this finding was not significant, $F(4, 69) = .85, p = .50$. The analysis showed that environmental concern, self-monitoring, habit nor self-consciousness significantly predicted change in shower time, NEP ($Beta = .037, t(73) = .3, p = .299$), SMS ($Beta = .045, t(73) = .375, p = .709$) SCS ($Beta = -.199, t(73) = 1.653, p = .103$) and SRHI ($Beta = -.06, t(73) = -.467, p = .642$), respectively.

A further measure of habit was devised using the standard deviation of the baseline shower time as being representative of habitual shower duration. Using this measure, a low standard deviation is interpreted as being indicative of strong habit as this would suggest higher levels of consistency with regards to shower time. Conversely, a higher standard deviation demonstrates lower levels of rigidity with regard to shower time and therefore lower habitual shower duration. A correlation analysis was conducted which examined the relationship between the standard deviation of shower time and the *absolute* change in shower time from baseline (T1) to intervention (T2), i.e., irrespective the direction of the change. It was found that there was a moderate positive correlation ($r = .321, p = .006$) showing that higher standard deviation in baseline shower time was associated with greater levels of change in shower time following the intervention. This suggests that individuals who had weaker habits with regard to shower time changed their shower duration to a greater extent than those who had stronger shower habits.

5.5 Discussion

The current study aimed to determine if a descriptive norms intervention, namely, feedback relating to shower duration of peers, could impact on shower duration of students at the University of Bath. It was hypothesised that following the provision of normative feedback, participants in both ‘above average’ and ‘below average’ conditions would change their showering duration in the direction of the norm provided. A further aim of the study was to establish if a social norms intervention could be effective in a private setting in the absence of a social group, as previous research had found that individuals are uncertain what is normal in private settings. Potentially confounding factors such as self-consciousness, self-monitoring, environmental concern and the conscious behaviour of habitually taking shorter showers were examined to ensure that any effect which was found was not as a result of these variables.

The findings showed a significant interaction effect from baseline to intervention shower duration. It was found that participants in the below average condition significantly increased their shower time following the provision of the normative information and while the above average condition decreased their shower time, this was not found to be a significant reduction. It is unsurprising that it was seemingly easier to increase shower duration than to decrease it. Change in behaviour was not found to be as a result of the potentially confounding factors which were considered. It was also found that those deemed to be in habitual states did not change their shower duration following the intervention.

5.5.1 Survey measures

5.5.1.1 Normative misperceptions

In the survey, participants were asked to estimate their own shower time, as well as that of their peers. It was found that respondents perceived their shower time to be very similar to that of other students, which was shown through the strong correlation between the responses on these questions. However, in actuality, participants showering time, which was

determined objectively, using the baseline shower data, was significantly lower than their perception of their true shower duration and the perceived shower duration of their peers. This appears to illustrate the extent to which individuals believe the manner in which they behave in private is similar to others, despite this being found to be inaccurate. These findings relate to the false consensus effect whereby individuals wrongly believe or overestimate the extent to which referent others share their beliefs, attitudes or behaviours (Ross et al., 1977). In simple terms, this bias can be described as individuals believing that others are the same as themselves.

It could also be interpreted that this finding indicates that the perceived behaviour of others serves to drive and influence individuals' own behaviour. This supports the findings of the previous study, and other research on normative misperceptions which show that if there is a belief that others engage in a particular behaviour that this can encourage engagement in that behaviour, even if this perception is inaccurate. Normative misperceptions function by way of encouraging individuals to behave in a way which they believe is in line with the referent group in order to be seen as similar to other group members (Neighbors et al., 2006).

5.5.1.2 Confounding factors

A regression analysis was conducted which explored the potential impact of self-consciousness, self-monitoring, environmental concern, and the habit of consciously taking shorter showers. It was anticipated that based on the nature of these variables relative to the study aims, that they may explain some of the variance in the model. However, analysis showed that the findings were unlikely to have been as a result of the factors which were measured through the use of the surveys, with the model explaining less than 5% of the variance. The analysis showed that none of the predictor variables made a significant contribution to the model.

These findings therefore indicate that the change in behaviour may have been driven purely by the normative intervention. It could be argued that the apparent response to the normative

information should indicate that individuals monitor their behaviour and therefore the SMS and SCS should have made at least some contribution. However, descriptive normative influence may be unconscious to some degree, and individuals may actually be unaware of the level of influence and the extent to which the behaviour of others influences their own behaviour. Ölander and Thøgersen (2014) posit that behavioural choices are often made automatically, based on cues by others in given situations and these cues largely influence individuals in an unconscious manner. This is shown in Nolan and colleagues (2008) study on energy use, whereby social norms resulted in the biggest reduction in energy in comparison to other factors, despite individuals in the study stating that the behaviour of others was the factor least likely to motivate their behaviour.

Further, it could also be questioned as to why the NEP was not a significant predictor of change, particularly as shower duration is an environmentally impactful behaviour. However, as the intervention was not framed in an environmental manner and the participants were unaware of the true purpose of the study, it would not have been expected that the NEP would be a predictor in the model. Rather, the study showed that the normative intervention worked irrespective of whether individuals were high or low in environmental concern. This illustrates that behaviour change messages may not necessarily need to be focused on an environmental outcome or framed in an environmental manner in order to achieve environmentally impactful behaviour change, but that descriptive normative information alone may in fact be sufficient to elicit behaviour change.

5.5.1.3 Self-presentation

Results showed that there was not a significant reduction in shower time for the ‘above average’ group, but rather just a trend towards a reduction in shower time. Despite the fact that on average, individuals in both conditions reported moderate to high levels of environmental concern, when presented with the normative information highlighting the discrepancy between their values and behaviour, they were not able to change their

behaviour accordingly. In line with cognitive dissonance theory (Festinger, 1957), it would have been anticipated that in order to reduce the dissonance between their apparent pro-environmental attitudes and excessive showering behaviour, that the 'above average' group would have attempted to reduce their shower time to a greater extent. This may provide reason to suggest that self-presentation strategies were being employed when the surveys were being completed, as it could be assumed that all participants would be aware that longer showers have a negative impact on the environment.

5.5.2 Shower data

The overall finding of the study with regards to the change in shower duration is similar to that of Schultz and colleagues (2007). Their study on energy consumption noted a 'boomerang effect' whereby when individuals were made aware that they were using less energy than their neighbours, this resulted in an increase in energy use. According to Blamey (1998), the cause of these boomerang effects may be either an attempt to calibrate behaviour in line with the norm, or simply as individuals view it as unfair that others are not making the same effort as themselves. Schultz and colleagues (2007) found that this boomerang effect was overcome through the addition of a buffering injunctive norm, which demonstrated approval for the behaviour.

Individuals in the below average condition may have had positive expectations about their peers shower duration, particularly as a result of the lack of visibility and the assumption that others engage in similar showering behaviours, as was shown through the survey data. However, when it was made explicit through the normative information that others were taking longer showers than they themselves were, this may have damaged the trust, resulting in an increase in shower time. This is in line with Jorgesen and colleagues (2009) suggestion that if individuals do not feel they can trust others to save water that this will in turn dissuade them from water saving behaviours. The normative feedback highlighted to those in the

below average condition that others were making less of an effort with respect to actively reducing their shower time which may have resulted in those individuals making less of a conscious effort to control their shower time. This potential lack of trust in their peers to behave in the same manner as them may have caused the significant increase in shower duration which was found.

It could also be suggested that there may have been some element of reactance to the intervention. Aronson and O'Leary (1982) found in the initial version of their study on showering in locker rooms that when they put up signage to encourage water conservation, this resulted in some individuals increasing their shower time. They interpreted incidences of longer shower taking as being indicative of participants' annoyance at the intervention, although it is not clear if this was measured or indeed an accurate assumption. It is a possibility that individuals, particularly those in the above average condition, may have objected to the intervention as it might have compromised their autonomy with regard to showering and control of their own behaviours. This is in line with Brehms (1966) theory on psychological reactance, whereby the desire to retain behavioural freedom results in resistance to any attempts to influence an individual's behaviour (Schwartz, 1977).

For the below average condition, making the descriptive norm salient explicitly stated to participants that many people take longer showers, effectively highlighting the prevalence of the undesired behaviour. While the intention of social norms campaigns is to guide individuals away from the undesirable behaviour, studies have found that making the undesirable behaviour salient can result in the increase of the target behaviour, even when the message highlights that it is an undesirable behaviour (Byrne & Hart, 2009). For the above average group, it was expected that participants would reduce their shower time in line with the social norm provided. While a reduction in shower time was recorded, this was not a significant change. This could possibly be as a result of vicarious moral licensing whereby if their referent group has been seen to behave in a desirable manner, this gives the

individuals a license to behave in the opposite manner, as their in-group have already established a 'good name' (Kouhaki, 2011). This use of 'compensatory ethics' (Moore & Gino, 2013) may explain the lack of a significant change in behaviour despite individuals being made aware that their behavior may not necessarily be in line with that of their peers, nor their environmental concern.

5.5.2.1 Private behaviours

It has been established that social norms function by way of facilitating continued group membership through behaving in line with the group norm (Goette et al., 2006). Due to the private nature of showering, and the typically social nature of normative influence, participants in the above average group may not have responded entirely as desired as they may have determined that their behavior was not visible to the referent group, thus removing the threat of social sanction as a result of a lack of adherence to the norm. When behaviours are not visible to others, such as private household behaviours, this can lower inhibition which may facilitate greater engagement in these potentially undesirable actions (Rook & Fisher, 1995). Participants are likely to be aware that their showering behaviour is relatively unknown to others and that any changes in behaviour, whether in the desired direction or otherwise, would not be known to their peer group. This relates back to the issue of conspicuous conservation and the possibility that altruistic or pro-social behaviours may only be engaged in out of a desire for the individual to present themselves in a particular manner to others (Griskevicius et al., 2010). This may also offer some explanation as to the ease with which the 'below average' group increased their shower duration despite reporting high levels of environmental concern.

The findings of the study support the teachings of the focus theory of normative conduct (Cialdini et al., 1990). By making the normative behaviour focal, despite longer showering being an undesirable behaviour in the case of the 'below average' group, and in opposition to the self-reported moderate to high levels of environmental concern, this encouraged

significant changes in behaviour. According to Cialdini and colleagues (2006), making the prevalence of the undesirable behaviour focal ultimately exposes the descriptive norm in a manner which has the potential to increase the unwanted behaviour, rather than dissuading individuals to participate. The resulting boomerang effect, similar to that found by Schultz and colleagues (2007), also indicates the protective aspect that private or invisible behaviours offers.

This finding may provide greater support to the existing literature on boomerang effects, and in particular Schultz and colleagues (2007) study. In the current study, it could be reasonably assumed that the boomerang effect occurred as a result of a desire to not deviate from the social norm. The findings here indicate that despite the presented norm being counter to an individual's self-reported environmental concern, the boomerang effect occurred nonetheless and without the threat of social sanction of others, showing that a boomerang effect is possible even when the normative behaviour is in direct conflict with the values of the individuals. This is something which was not addressed in Schultz's study as participants' environmental values were not evaluated as part of the study. The current study also differs from Schultz's in that false allocation of groups and randomised feedback was used. This meant that for some individuals, the feedback they received may have seemed unrealistic to some extent but this still resulted in a change in line with the norm.

5.5.2.2 Habitual behaviours

It was anticipated that those who are high in habitual states may not respond to the normative information provided, particularly as no contextual change occurred which typically aids in the facilitation of breaking and forming new habits (Lally & Gardner, 2013). Using standard deviation of shower duration in the baseline period as a measure of habitual shower behaviour, it was found that baseline habit strength was correlated with change in shower time. This indicates that those who demonstrated habitual shower behaviour did not change

their shower time as a result of the descriptive norm. Conversely, the shower behaviour of those who were shown to be non-habitual with respect to shower duration was found to change following the provision of the normative information.

This indicates that while it was found that social norms may be effective in private settings, they appear unable to penetrate habits sufficiently to change behavior. Therefore, in order for social norms to be effective in similar domains in future a situational change may be necessary to facilitate this. Chapter 3 showed that only a minor situational change, namely the addition of a sticker with normative information, was necessary to form new habits in the case of fume hood closure. Accordingly, a simple visual reminder such as this may be a suitable contextual change with sufficient strength to impact on showering habits.

5.5.2.3 Effect despite boundary conditions

Despite the study being operationalized in a manner which aimed to ensure high levels of scientific rigor, a change in behaviour was still evident in the short time frame of the data collection. Although the change in behaviour for the above average condition was not significant, there was a clear trend in the data, showing a gradual change in the direction of the descriptive norms provided. Prentice and Miller (1992) published an article which is relevant to the findings here. They discuss how the method of significance testing may present a misleading account on how much the reader or researcher should take away from a finding. They posit that the importance of an effect can be demonstrated through minimal manipulations of the independent variable resulting in a change in the dependent variable, which they explain with the examples of the minimal group effect (Tajfel, Billig, Bundy, & Flament, 1971) and the mere exposure effect (Zajonc, 2001).

The current study appears to add a further novel element to Prentice and Millers (1992) point on the importance of small effects from a normative influence perspective. When we consider Tajfels (1978) work on the minimal grouping effect, it demonstrates individuals' deep desire to be part of a group. Despite offering participants minimal information about

group membership, individuals were still found to respond in line with this arbitrary group. In the case of Cialdini, however, his work on social norms has shown that largely, individuals like to be normal. The current study has shown, in line with Prentice and Millers (1992) discussion that by presenting minimal information about what is ‘normal’ amongst peers, even without any context, a change was still evident. The effect was found despite only basic information presented, similar to the minimal grouping effect, and in a private context where behaviour was not visible. This may suggest that greater levels of desired response may be found in situations where more meaningful normative information is provided which is more closely aligned with respondent’s group preferences.

The present study’s effort to verify with relative certainty that any effect which was found was as a result of the application of the intervention and not due to confounding variables or methodological flaws was ensured through careful methodological planning. Firstly, the study used a randomized allocation of participants to conditions, secondly, normative feedback was determined through the use of a randomly generated numbers of minutes and, lastly, a neutrally framed message was utilized which did not relate to the environment so as to mask the true aims of the study. A significant interaction effect was found despite the reduction in shower time for the above average group not being statistically significant. Typically, a finding which does not meet the traditional ‘ $p < .05$ ’ threshold would be deemed to be ineffective. Using this approach in the current study suggests that a descriptive normative intervention is not capable of reducing shower duration. However, a small change was still present despite the inclusion of the three potentially confounding factors which may have prohibited behaviour change. Had the study assigned individuals according to baseline shower time and provided factual feedback relating to the norm, this would have likely resulted in a significant reduction in shower time.

5.5.3 Limitations and recommendations for future research

There were several limitations of the research which must also be addressed. As discussed above, the study employed various strategies to ensure rigour. Should a similar intervention be used in future research, it may be more beneficial to assign participants to the experimental condition based on their actual baseline behaviour. It could be expected that the trend in behaviour change which is visible in the current study would be more pronounced, due simply to the fact that individuals who are genuinely taking longer showers will have more room to decrease and vice versa. Further, as a random number generator was used in order to create the individual's normative feedback in an unbiased manner, this resulted in an unbalanced number of participants being assigned to each condition. Significantly more participants were told that they were taking shorter showers than their peers than those who were told they were taking longer showers. This may have resulted in a comparatively stronger effect for the below average condition and it could be interpreted that perhaps if the feedback had been more balanced, this may have resulted in a more equal influence for both conditions. Future research should take this into consideration.

The survey did not explore the extent to which participants took showers in places other than their on-campus accommodation such as the gym, for example. This may have had some impact on the frequency of showers taken. While this may not have necessarily impacted the mean shower time of each participant, it may have impacted the level of data available for each participant which may have provided more details about showering behaviours and patterns in general. Further, it must also be noted that due to the number of individuals living in each house, this may have limited the extent to which shower behaviour could be changed, due to time constraints associated with the demand from others to use the shower.

The survey aspect of the study did not include questions on group membership, which may have been an important factor in terms of the extent to which participants were influenced

by the social norm, and this factor may have been able to explain a greater portion of the variance had it been included. Group membership is an important component of social identity, as postulated in social identity theory (Tajfel & Turner, 1986). Terry and colleagues (1999) found that the normative behaviour of a relevant reference group, with which the target individual may feel a stronger sense of group membership or shared sense of identity, was more strongly related to the intention to engage in behaviour. While it was assumed that there would be a sense of group membership amongst university peers, this information was not gathered. As the study began only two months into the academic year, there may not have been a strong sense of social cohesion between the housemates, or at least it may have been stronger for some than for others. This may have impacted the effectiveness of the normative intervention, should there have been a lack of perceived connection or group membership amongst the peers, and rather than using a consensus heuristic as in the case of in-group membership, instead employed a contrast heuristic due to perceiving the group as an out-group. Future similar research should attempt to establish the various levels of group membership of the target individuals as this may provide some indication and explanation for particular behavioural responses. This may also be a useful strategy to employ in advance of any social norms intervention as this may establish what group the target individuals most strongly relate with and this can help inform the layout of the normative intervention, using this group as the referent normative group which may result in greater levels of behaviour change.

As a result of time and resource constraints and due to data collection occurring just prior to the winter vacation period, the study was only conducted over a four week period, with two weeks each for baseline and intervention periods. A longer data collection period would have allowed for a greater number of showering events to be recorded, providing richer data, particularly for those participants who showered less frequently. This would also provide the opportunity to see if changes in behaviour remained stable following the two-

week intervention phase, or if effects which were found became more pronounced with time. However, it must be noted that failure to explore the long term impact of normative interventions is a criticism which could be applied to much of the empirical research on normative influence.

Throughout this study, the behaviour of showering has been deemed as a private behaviour, in that how an individual engages in their shower behaviour is typically not known to others. It could be argued that while the behaviour of showering is not typically visible to others, others living in the same dwelling, particularly where showers are used by more than one individual, shower duration may still be known. However, beyond the privacy of the home, the general public and potential referent groups would neither be visible to nor have visibility of individuals engaging in showering behaviour in their home. Therefore, while it could be stated that in the immediate environment of the home, there may be some sense of an awareness of shower behaviour, in terms of the wider social group and society, there is little by way of a presence which might influence shower behaviour.

Finally, the demographics of the sample population must also be considered here. Research suggests that younger individuals may be more susceptible to normative influence as a result of pressure from peers to conform (Pasupathi, 1999). As the current research was conducted using first year students in their first semester, the desire to establish new acquaintances amongst peer groups may have resulted in greater adherence to the descriptive norm which they were provided with in some instances. To that end, the findings of this study may not be broadly generalizable as older adults may not respond to normative information in the same manner.

5.5.4 Implications

There are practical implications of the findings of this study. Private behaviours have been identified as an area which should be targeted in terms of environmental behaviour change

campaigns. This is an area which has been largely overlooked in the literature despite exploratory research in the previous chapter showing that behaviours which are not largely visible are those which are deemed to be the most environmentally harmful. This study showed that a social norms intervention is likely to be an effective mechanism for behaviour change despite the lack of a visible social group to enforce behaviour change. While a significant reduction was not found there was a clear trend visible, which could likely be strengthened in a practical application of this study without the randomization of condition allocation and feedback.

Schultz and colleagues (2007) study on energy consumption, which showed a similar boomerang effect, commented on the fact that energy saving behaviour has a direct personal benefit to the individuals involved, and this may be a confounding factor which should be taken into account. However, in the case of the current study, there is no personal benefit to the participants as water bills are inclusive in student's accommodation costs, irrespective of levels of use. Therefore, this study showed to some extent that social norms may be effective despite no personal benefit to the target individual. Many previous studies on normative behaviour change have had the added factor of the possibility of a personal gain as a result of changing behaviour, which may to some extent muddy the effectiveness of the social norm.

Further, in recent years, utilities companies have employed social norms as an incentivising strategy to encourage customers to reduce consumption in the home. This research is an important indicator that while this may be somewhat useful for those that are consuming in excess of the norm, those that are already consuming at lower levels may be encouraged to increase their consumption in line with others. Utilities companies should instead perhaps only provide specific normative feedback to those that are consuming greater amounts than the norm.

5.6 Conclusion

To conclude, this chapter attempted to determine the efficacy of a social norms intervention in a private setting, in the absence of a social group. A multitude of literature exists which highlights the efficacy of social norms and normative influence in general and how they impact on human behaviour. However, to date the literature does not address what happens when behaviours are not visible. As maintenance of group membership along with the potential threat of social sanction are crucial components for the functionality of social norms, it was previously unknown whether a normative intervention had the power to influence behaviours in a private setting where these components were irrelevant due to a lack of visibility. Despite a number of measures in place to ensure scientific rigor, it was shown that a change in behaviour occurred which appeared to be purely as a result of the application of the normative intervention. This finding appears to present a novel mechanism for targeting behaviour change in private contexts. This could open up a range of environmentally impactful behaviours to target in a simple manner. Future research should therefore attempt to further validate this method through the use of actual shower duration and accurate condition allocation.

Chapter 6: General Discussion

The current thesis has explored the efficacy of descriptive normative interventions in the real world setting of a university campus, targeting both staff and students. The preceding chapters have also indicated the extent to which normative misperceptions occur, particularly in the case of private behaviours, and how these misperceptions may have implications for the environment as a result of how they influence behaviour. The research targeted behaviours which would not typically provide an incentive to change behaviour, such as financial reward and were therefore deemed important to explore for future workplace behaviour change campaigns. The current chapter will now review and summarize the findings which were uncovered, and discuss the theoretical implications of this research, as well as future applications and the limitations of the research, before providing final concluding remarks about future research and limitations.

6.1 Summary of completed work

The current thesis comprised of background, investigative and applied work in the field of social norms, with a focus on the utility of descriptive norms in settings where there is no personal incentive to change, as well as the significance of private behaviours with regard to normative perception and influence. The broad aim of this thesis was to explore further contexts within which social norms can be applied effectively and simply in order to achieve an environmentally positive outcome. A further novel aspect of the research was the omission of any environmental framing of messages, in order to assess the effectiveness of a pure social norms message which has not been biased by any potential environmental concerns or attitudes.

Chapter 2 consisted of a literature review which presented some of the background literature on social norms over several decades as well as the important distinction between injunctive and descriptive norms. This chapter then focussed more specifically on the application of

social norms for environmental outcomes as well as potential barriers to behaviour change and normative influence in general. This literature review highlighted the range of research which has been conducted in the field of social norms while also highlighting the necessity to explore the efficacy of normative influence in situations where there is no incentive to change. The current thesis also aimed to utilise real world settings which offer more generalisability in terms of applicability of findings than a manipulated environment can offer.

Chapter 3 presented a two-study exploration of the efficacy of using descriptive norms in the workplace to reduce energy consumption. These two studies aimed to explore several factors including the extent to which a social norms intervention can change behaviour in the workplace, in the absence of any personal incentive for the target individual to change behaviour. Many previous studies which use social norms as a pro-environmental behaviour change mechanism have targeted behaviours from which the individual would benefit, such as saving money on energy bills (Schultz et al., 2007). Therefore, it was important to establish if social norms could be effective in highly consumptive environments such as the workplace, without the necessity for a personal reward or benefit. In a similar vein, the research in this chapter aimed to determine if environmentally beneficial behaviour change could occur without framing the intervention with an environmental message. Finally, as the workplace typically involves automatic and habitual behaviours, it was important to establish if habits could be broken or formed in the absence of a significant situational change. The findings in Study 1 appeared to satisfy all three of these research questions, as shown through the significant reduction in energy use. This yields promising results in terms of a cost-effective and easy to implement intervention which has the potential to achieve significant environmental impact through reduced energy consumption. However, an apparent period of reactance following the intervention phase appeared to show that the presence of the researcher was having an impact on the response.

The replication in Study 2 showed that when the researcher was not present, lab users responded to the blank ruler which may have acted as an injunctive norm in this case. Nonetheless, a significant change in behaviour was found, however it was interesting to note that the addition of the normative information in the intervention phase did not make any difference in terms of energy consumption beyond the baseline measure. This could be because the lab users had maximised the extent to which they could close their fume hood, which is supported by the fact that VAV readings were at a similar level to those in Study 1 following the normative intervention phase. The findings of the chapter therefore appear to indicate that both injunctive and descriptive norms are effective in the workplace, in the absence of personal incentives and without the need to use an environmentally framed message. This chapter appears to show how injunctive and descriptive norms both function effectively but through differing paths and mechanisms.

Chapter 4 presented a two part online study, the focus of which was exploratory in nature and aimed to gather a clearer understanding of the extent of normative misperceptions of common behaviours. While a multitude of previous research has explored the phenomenon of normative misperceptions of behaviours, these studies have generally focused on a single behaviour or category of behaviours such as drinking alcohol (Neighbors, Larimer and Lewis, 2004) or drug use (Perkins, 1997), for example. The study herein addressed an apparent gap in the literature in terms of gathering a more comprehensive list of behaviours which may be prone to normative misperceptions beyond that of singular, personally harmful behaviours. The findings indicated that on the whole, private behaviours were largely found to be susceptible to normative misperceptions. These behaviours were also shown to be those which were perceived as being worse for the environment, indicating that normative perceptions of a vast array of environmentally impactful behaviours are inaccurately perceived. Due to the established influence of social norms, it could be

anticipated that these normative misperceptions may have detrimental impacts on the behaviour of others.

Chapter 5 aimed to further explore the relationship between normative influence and private behaviours through the practical application of a descriptive norms intervention targeting shower duration. The aim of the study was to establish whether descriptive norms had the power to influence private behaviours, in the absence of a referent social group and the threat of social sanction. While the study employed rigorous methods and randomised controls, a significant interaction was found. Results showed that irrespective of baseline shower duration, following the provision of descriptive normative information, those who were told they were taking shorter showers than their peers significantly increased shower time, while those told they took longer showers decreased. While the decrease was not found to be significant, a clear trend was visible and this is likely to be more pronounced should actual shower duration be used to assign participants to conditions. Nonetheless, it was found that private behaviours are responsive to descriptive norms, which provides a promising outlook with regards to environmentally beneficial behaviour change relating to the many consumptive behaviours which occur in private settings.

6.2 Theoretical implications and applications

Having provided a summary of the work undertaken in each chapter it is now possible to consider the theoretical implications of the findings in from an integrated perspective. Some of the main findings of the thesis will now be discussed below.

6.2.1 Impact of descriptive norms on private behaviours

Private behaviours such as showering do not have social motivations, yet it is apparent from the findings of Chapter 5 that social norms still possess powers of influence in these settings. While only a starting point in this novel topic, it would appear that the findings here indicate the potential for widespread behaviour change, should social norms be found to be an

effective tool for behaviour change across a range of private, environmentally significant behaviours.

It could be suggested that public behaviours are largely a deliberate attempt to be the right person in the right place at the right time, which explains why people are responsive to social norms in social contexts. Research on self-monitoring and self-presentation has demonstrated that in social settings, individuals engage in impression management strategies in order to behave in a manner which is consistent with societal or group expectations and norms. To date, the literature has not explicitly addressed the extent to which group expectations and norms influence behaviours in the absence of either behaviour models or observers. Literature on public self-consciousness suggests that individuals engage to some extent in controlling the image they present, guided by the individual's awareness of how they are viewed by others. Conversely, private self-consciousness describes the act of introspection and guiding behaviour based on the internal self and values. However, it would appear that in private settings, where image presentation is irrelevant, concern for how others may perceive an individual is still evident through the behavioural response which is seen in Chapter 5. This shows that the desire to be similar to referent others goes beyond visible behaviours and may suggest a more holistic desire to behave in a manner which reflects that of the social group in a wider range of settings, and is not restricted to those behaviours which are visible to the group. This thesis has therefore identified the field of private behaviours as being responsive to descriptive normative messages.

It is not a surprising finding that for behaviours which are visible to us, we have more closely aligned perceptions of what is normal than for behaviours which are not visible and which occur in private settings. It is thus logical, that the provision of information about what others do in these settings will help to calibrate behaviour and allow our actions or at least our perceptions of others to fall in line as this uncertainty is reduced. This finding indicates

that by simply making the behaviour of others salient, this can lead to meaningful changes in behaviour. It is likely that this will also reduce the existing discomfort associated with private behaviours.

The implications of this finding are wide reaching. As many environmentally significant behaviours occur in the home or out of view of others, the findings here suggest a wealth of opportunity with regards to novel behaviours which may be suitably targeted through the use of descriptive norms. The simplicity of the intervention strengthens the appeal of rolling out descriptive norms interventions to a variety of behaviours. Simple labelling on products which are used in conjunction with target behaviours may be sufficient to impact behaviours. For example, a descriptive norms message about shower duration on a shampoo bottle may help to encourage shorter shower taking. Ultimately, private behaviours would appear to be a domain of actions which have remained largely untapped with regard to normative interventions and have the potential to make significant reductions with regard to carbon footprint reduction, particularly in the case of common daily behaviours.

6.2.2 Normative influence where there is no incentive to change

The findings of the applied studies in Chapters 3 and 5 indicate the effectiveness of descriptive norms in real world settings where there is no personal incentive to change. In much of the previous literature on social norms, research has been conducted in manipulated environments (for example, Cialdini et al., 1990) or in situations whereby there has been a personal incentive to change behaviour beyond normative influence alone (for example, Schultz et al., 2007). While some descriptive norms research has been applied in situations where there is no obvious incentive to change such as hotel towel reuse (Goldstein et al., 2008) and theft of natural artefacts (Cialdini et al., 2006), this factor has not been explicitly addressed in the literature. The current thesis, however, has found that change occurred in both the workplace setting of the chemistry labs and the University halls, neither of which

offered participants a personal motive to change behaviour beyond that of alignment with the status quo.

This offers an important further dimension to the field of social norms research as this suggests that a simple intervention which merely provides the target audience with information about the behaviour of others, may be sufficient to elicit a significant and sustained change in behaviour. From an environmental perspective, workplace behaviour change has been noted as being particularly difficult to change (Blake, 1999), however the use of a social norms strategy allows individuals in the workplace to retain their autonomy and doesn't compromise their work. It can be seen from Chapter 3 that a descriptive norms intervention can be subtle and unobtrusive, allowing individuals to choose whether or not to engage with the information, yet still result in a desirable long term change. Similarly, in Chapter 5 students were shown to respond to the descriptive norms information which was presented to them, despite the fact that students' accommodation bills remain constant irrespective of the level of use of utilities.

These findings that meaningful behaviour change can occur without the need for costly incentives may offer hope to organisations who do not have the resources to fund regular rewards and benefits to promote behaviour change. Again, this shows the simplicity and ease with which a measurable and substantial change in behaviour can occur, without the need to invest resources. Similar interventions can be implemented in a broad range of settings of varying sizes within which it may not have previously been perceived as possible to implement change due to the issue of incentives.

6.2.3 Environmental impact without framing

Many campaigns aimed at targeting environmentally significant behaviours frame their messages in an environmental manner. However, environmental messages may not necessarily appeal to all individuals nor fall in line with their values. Consequently, numerous targeted campaigns aimed at impacting environmentally significant behaviours

may be overlooked or ignored, as the messaging and framing of these types of message are unlikely to engage individuals who are not interested in the environment. However, it has been shown throughout this thesis that environmentally impactful behaviour change can occur without the necessity of environmentally framed messages or campaigns. This broadens the possible scope of the potential impact of a single intervention, as using norms removes the need to invest resources on tailoring messages to target specific values and attitudes.

It would appear that the desire to be similar to referent others overrides other values to a certain extent and therefore future behaviour change campaigns may benefit from simply highlighting the desired behaviour of others. Like the findings on incentives, the finding that it is not necessary to frame messages specially to appeal to the target behaviour greatly simplifies the challenge associated with developing a behaviour change campaign. Descriptive norms have therefore been shown to be highly versatile in terms of their reach and ability to change specific behaviours without the need to engage target individuals with a specific message.

These findings concur with Griskevicius and colleagues (2008) suggestion that social norms have the potential to be a low-maintenance, low-resource solution to environmentally focussed behavioural issues. This also highlights the possibility that behaviour change strategies need not be tailored to specific values or characteristics and may simply require making the desired behaviour the focal point of the intervention, in line with the focus theory (Cialdini et al., 1990). Additionally, in the case of Study 1, appealing to group membership is likely to have been an important factor. The ease of implementation of such strategies means that simple normative interventions have the potential to induce widespread behaviour change to diverse audiences with minimal associated costs.

Making the norm salient, in line with the focus theory of normative conduct (Cialdini et al., 1991) appears to have been an effective strategy in terms of influencing the target behaviour

in all studies. In the case of Chapter 3, this strategy ensured that at no point were participants drawn to the prevalence of their own behaviour by providing information about the current descriptive norm in their labs and department in terms of leaving fume hood sashes open. Rather, by drawing lab users' attention to the target behaviour of the desirable lower fume hood sash height of other universities, this ensured that the lab users were not aware of the extent to which their peers in their Chemistry department left their fume hoods open which may have resulted in a potential boomerang effect (e.g. see Schultz et al., 2007). Similarly, in the shower study in Chapter 5, participants were given a target to aim towards, rather than explicitly stating what their own shower behaviour was.

6.2.4 Importance of making behaviours salient

The findings overall, point to the potential importance of offering individuals a mechanism by which to measure and quantify somewhat arbitrary behaviours. In the case of private behaviours, it was shown that individuals do not know what is normal. It was also shown that when asked to estimate their own showering time, participants' responses in Chapter 5 were significantly different to their actual shower time, as measured objectively using the data logging devices. It must be considered possible that these misperceptions about individuals self-reported activities may be present across other behaviours. This may be because in private, for example, there is little by way of reminders about how individuals should behave in these environments, and thus, no one to point out if individuals are spending too long engaging in a certain behaviour, for example.

In Chapter 3, individuals were provided with a means by which to quantify their behaviour in terms of how open they left their fume hoods when not using them, which appeared to draw awareness to the behaviour and the manner in which it was engaged in. This was particularly evident for Study 2 where it would appear that by providing the ruler, this allowed lab users to literally measure their behaviour and may have activated the injunctive norm relating to fume hood use. The focus theory of normative conduct (Cialdini et al.,

1990) was relevant throughout this thesis, in terms of the importance of providing a focal norm to encourage and guide behaviour. However, it would also appear that the salience of the individuals' behaviour itself is also of significance, as it seems that individuals may not have been consciously or explicitly aware of their own actions. The interventions in the applied studies not only drew attention to the behaviour of others, but also brought the behaviour of the target individual in to focus. This apparent lack of awareness may be due to the automaticity of workplace behaviours or typical household behaviours, and may not be so evident in other less automatic behaviours. These habitual actions may be overlooked to some extent resulting in an unconscious engagement in the behaviours. To that end, both Chapter 3 and Chapter 5 demonstrated that drawing attention to the behaviour in question and allowing objective measurement may be a strategy for future interventions.

Furthermore, making the norms salient is important to rectify any pre-existing normative misperceptions which may be present. According to the findings of Chapter 4, normative misperceptions are seemingly prevalent, particularly with regards to those behaviours which have been rated as private. The greater the incidences of misperceptions of normative behaviours with regard to environmentally significant behaviour the greater the likelihood that this will encourage behaviour change in line with these misperceptions. This behavioural conformity to these misperceptions therefore results in the misperception eventually becoming the true norm which will serve to validate the perceptions and behaviours of individuals by means of positive feedback about their behaviours. Wenzel (2005) and Berkowitz (2003) state that in order to break this loop of misattribution it is important to correct individuals' inaccurate perceptions through the use of feedback, which will in turn impact behaviour. In the case of private behaviours which are environmentally harmful, it is important to correct downwards the extent to which individuals perceive that others may engage in private consumptive behaviours. Of course, should it be the case that the descriptive norm in fact indicates greater incidences of environmentally harmful

behaviours then the injunctive norms should be activated in such situations. Making the injunctive norm focal rather than the descriptive norm in contexts where the descriptive norm may promote engagement with an environmentally harmful behaviour will reduce the likelihood of a boomerang effect occurring. This describes the situation where drawing attention to the prevalence of the ‘bad’ behaviour results in an increase in that behaviour, as seen in Cialdini and colleagues (2006) study, for example.

6.2.5 Potential reactance responses

In both Study 1 in Chapter 3 and the Study in Chapter 5, it could be interpreted cautiously that reactance occurred, however this cannot be determined with certainty. In Chapter 3, the spike in behaviour immediately following the end of the period where the researcher was present in the labs may be attributable to this phenomenon. Similarly, in Chapter 5, students’ inability to sufficiently reduce their shower time may also be construed as being due, in part, to some element of reactance. In Rains (2013) meta-analysis of psychological reactance, it was surmised that the use of an intervention can threaten the perceived freedom of an individual whose response then aims to restore this disparity by detracting from the target message (Smith, 1977), or indeed engaging in behaviours which are in conflict with the message (Worchel & Brehm, 1970), or finding greater pleasure from the counter behaviour (Hammock & Brehm, 1966). However, as previously mentioned, any assumption about the occurrence of reactance must be treated as speculative in this case.

Moral licensing may also offer a potential explanation for these behaviour responses. Moral licensing can be defined as a situation whereby an individual has engaged in a ‘good’ behaviour, and believes that this allows them to subsequently indulge in socially undesirable behaviours (Monin & Miller, 2001). Increased confidence in an individual’s self-image as a result of engaging in the moral or desired behaviour leads to less concern about ensuing behavioural transgressions. Having engaged in greater levels of fume hood closure during the intervention period than during previous times, this may have elicited the sense of

previous good behaviour, therefore warranting this subsequent undesirable behaviour in Chapter 3. In the case of the Study in Chapter 5, when students were informed that their shower behaviour was better than others, this allowed them an increase from their baseline. This effect has been shown to occur even in instances whereby engaging in the undesired behaviour results in financial costs. For example, Tiefenbeck, Staake, Roth and Sachs (2013) found that providing feedback about moderate energy consumption resulted in an increase of energy use. This is similar to the initial finding of Schultz and colleagues (2007) following the provision of normative information relating to neighbourhood energy use which was interpreted as a boomerang effect of the intervention.

6.3 Limitations and areas for future research

While the findings of the above studies have provided some useful and informative material for the field of behavioural science, these resulted in further questions which were not possible to answer as a result of time and resource limitations, which will be addressed here. Accordingly, there are some areas which would benefit from future exploration which will be outlined below.

One of the key limitations of this thesis which must be addressed is that of the sample which was used for the applied research. While there was a clear behavioural response to the interventions which were applied, it cannot be stated with certainty that these findings would be widely applicable, due to the sample for these studies consisting solely of individuals at the University of Bath. The socio-economic status of both employees and students attending the University may not be comparable with the national average which may impact the findings to some extent. Despite the interventions in both studies being framed entirely neutrally, there may be a possibility that individuals with different backgrounds might have responded differently. It would therefore be useful to explore similar research using a sample with a more diverse demographic for comparative purposes. This will allow the results to be more widely generalizable which will be important in terms of the validation

of these methods so that they may be used more extensively for behaviour change in other settings.

Furthermore, while it was important to demonstrate that behaviour change was present despite no incentive to change, the use of students in the shower behaviour study in Chapter 5 may be somewhat restrictive in terms of generalisability to the adult population as a whole. While the messages were intentionally framed neutrally, it must still be considered that utility bill payers would have a financial incentive with regards to excessive use of water. However, it must also be reiterated that the use of financial incentives is not always an effective behaviour change mechanism. Therefore, future research to further explore the efficacy of descriptive norms to reduce environmentally harmful household behaviours should include a sample who are responsible for paying the bills, in order to see if this is a confounding factor with regards to behaviour change. Furthermore, the theory on habit posits that habitual behaviours are more easily altered following a contextual change (Verplanken et al., 2008). As students had only been resident on campus for a number of weeks before the intervention began, their shower habits may have been easier to change than they would be for residential individuals who have not recently moved. Therefore, it would also be important to conduct this research on a sample of individuals who have been resident in their current dwelling for a long period of time, in order to determine if this intervention can penetrate behaviours without the necessity of a recent contextual change.

The research herein intentionally avoided using an environmental message along with the descriptive norm so as not to muddy any potential effect of the intervention, as explained previously. However, future studies may add the environmental message which could serve as a supportive injunctive norm in a similar manner. In order to avoid future incidences of the boomerang effect as was potentially found here, particularly in the case of Study 1 in Chapter 3, it must be established at what point information should no longer be presented to individuals so that social norms can be used more effectively to target environmentally

harmful behaviours. Future research in this area should establish at what point normative feedback should be removed so as to avoid this apparent encouragement of increasing engagement in the target and undesirable behaviour. Individual differences must also be considered as, despite the variables which were tested in the current study being found to make no contribution to the model, there may be other individual differences present which were not accounted for. These differences may explain the nature of the boomerang effect which was seen for the below average group and should be explored in further research, as it may be the case that individuals respond to normative information in differing ways.

In the case of the studies conducted in Chapter 3, the lack of a control group presents an important limitation which may question the validity of the results to some extent. Despite various measures taken to establish that there was no confounding factors which may have result in the change of behaviour independent of the intervention, this was not measured objectively through the use of a control group. Future research should therefore be conducted in a similar setting with the inclusion of a control group to ensure that any behaviour change which was recorded was not simply as a result of seasonal differences, change in staff or any other potentially confounding factor. This will help to validate the social norms intervention as a robust behaviour change mechanism which can be employed in a variety of laboratory settings.

As discussed in Chapter 5, in order to determine the effectiveness of the descriptive norms intervention alone, various steps were taken to ensure scientific rigour. Despite both group allocation and feedback being assigned randomly, an effect was still found. However, it must be considered that had group allocation and feedback been determined based on the actual baseline shower duration of the participants that this may have resulted in a greater change in behaviour. To test this assumption, future research should replicate the study in Chapter 5, but use actual shower time to inform group allocation and to provide the normative information. In a real world setting, it is more likely that any intervention which

would be employed on a longer term basis would make use of the true behaviour of the target individuals. It is therefore important to replicate the study in Chapter 5 with the inclusion of this important change. It may be the case that the effect which is found is greater, as it will be based on realistic shower times and feedback. This will be more representative and generalisable with regards to how a practical application of this research may perform.

6.4 Concluding remarks

To summarise, this thesis aimed to broaden the knowledge on the use of descriptive social norms and their effectiveness as a tool to encourage pro-environmental behaviour change. It was suggested by Larimer and Neighbors (2004) that the range of behaviours which it is possible to influence through the use of descriptive norms is not yet understood. The current thesis, however, goes some way towards a better understanding of this, with the addition of both private behaviours where the social component of normative influence is absent and behaviours where there is no incentive to change. Many behaviour change intervention strategies focus narrowly on individual values and message framing in order to elicit change, however the current thesis appears to indicate that focusing on specific values or messages may not be necessary to evoke a desired response. In line with historical research on social influence, it would appear that the desire to be similar to others remains a strong mechanism for behaviour change and that this can now be utilised across a range of behaviours both in private settings and workplace settings without the need for resources, framing or targeting values. Future research should continue to explore these avenues as substantial change in the field of environmentally significant behaviours may be possible to achieve through the use of the simple, cost-effective behaviour change mechanism of descriptive norms.

Chapter 7: References

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Chapter 8: Appendices

8.1 List of appendices

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Appendix A

Behaviours ordered by respondents' self-reported perception of environmental impact
(higher scores represent behaviours which are more harmful to the environment)

Behaviour	Mean	SD
Leave lights on at night	6.137	1.11
Run tap while brushing teeth	6.059	1.05
Leave heating on at night	6.000	1.11
Waste food	5.941	1.14
Wash towels frequently	5.780	1.11
Leave charger on	5.706	1.12
Wash clothes frequently	5.706	1.03
Charge phone at night	5.627	1.36
Use bleach to clean	5.560	1.03
Overfill kettle	5.469	1.80
Use hairdryer	5.380	1.09
Holiday abroad	5.275	1.40
Use dishwasher	5.216	1.19
Use heating to dry clothes	5.176	1.41
Flush toilet every use	5.157	1.14
Shower daily	5.157	1.24
Use washing machine	5.118	1.05
Use mobile phone	5.098	0.94
Disobey speed limit	5.000	1.08
Preheat oven	5.000	1.02
Watch television	4.960	0.75
Buy cheap clothes	4.700	1.33
Use non-bio washing product	4.686	1.50
Go to cinema	4.420	0.67
Eat in a restaurant	4.412	1.15
Use social media	4.216	0.99
Listen to music	4.157	0.73
Clean the house	4.137	0.98

Wash dishes	4.059	1.14
Read books	3.824	1.18
Socialise	3.680	1.30
Eating products by use by date	3.471	1.29
Eat food past use-by date	3.431	1.12
Playing sport	3.392	1.15
Walking	3.176	1.21
Eat fruit & veg	3.040	1.52
Exercising	2.882	1.23
Low temperature on washing machine	2.824	1.31
Unplug devices when not in use	2.765	1.96
Buy organic food	2.520	1.28
Take short showers	2.373	1.20
Buy sustainable goods	1.920	1.16
Use compost bin for food	1.647	0.96
Reuse plastic bags	1.490	0.81

Appendix B

Behaviours ordered by respondents' self-reported perception of discomfort (higher scores represent greater discomfort)

Behaviour	Mean	SD
Disobey speed limit	4.184	1.97
Waste food	3.857	2.24
Flush toilet every use	3.708	2.23
Leave charger on	3.653	1.91
Buy cheap clothes	3.490	1.86
Run tap while brushing teeth	3.490	1.85
Wash towels frequently	3.458	1.95
Leave heating on at night	3.388	1.97
Leave lights on at night	3.367	1.79
Eat food past use-by date	3.347	1.94
Eating products by use by date	3.306	1.84
Wash clothes frequently	3.292	1.92
Overfill kettle	3.286	1.93
Charge phone at night	3.265	1.94
Use bleach to clean	3.184	1.82
Shower daily	3.163	2.11
Take short showers	3.146	1.82
Use heating to dry clothes	3.125	1.59
Use hairdryer	2.918	1.95
Use non-bio washing product	2.875	1.71
Preheat oven	2.688	1.67
Use washing machine	2.633	1.55
Use dishwasher	2.583	1.57
Socialise	2.510	1.58
Use social media	2.490	1.60
Unplug devices when not in use	2.490	1.68
Holiday abroad	2.469	1.60
Exercising	2.388	1.68

Clean the house	2.347	1.45
Playing sport	2.313	1.50
Go to cinema	2.306	1.36
Low temperature on washing machine	2.265	1.40
Use mobile phone	2.184	1.56
Wash dishes	2.184	1.35
Watch television	2.167	1.49
Buy organic food	2.082	1.35
Use compost bin for food	2.082	1.55
Eat in a restaurant	2.061	1.18
Walking	2.061	1.42
Buy sustainable goods	2.041	1.22
Read books	1.959	1.31
Listen to music	1.875	1.27
Reuse plastic bags	1.735	1.22
Eat fruit & veg	1.714	1.22

Appendix C

Behaviours ordered by respondents' self-reported perception of privacy (higher scores represent greater perceived privacy)

Behaviour	Mean	SD
Wash towels frequently	4.574	2.30
Flush toilet every use	4.509	1.96
Eat food past use-by date	4.491	2.22
Wash clothes frequently	4.352	1.97
Run tap while brushing teeth	4.327	2.01
Overfill kettle	4.327	1.88
Eating products by use by date	4.231	2.10
Read books	4.145	1.96
Shower daily	4.111	2.03
Charge phone at night	4.109	1.97
Take short showers	4.075	2.11
Use non-bio washing product	4.058	2.01
Use heating to dry clothes	3.963	2.00
Unplug devices when not in use	3.927	2.10
Leave heating on at night	3.923	2.07
Low temperature on washing machine	3.923	2.07
Leave charger on	3.906	1.82
Clean the house	3.885	2.09
Waste food	3.868	1.93
Use bleach to clean	3.846	1.99
Use dishwasher	3.778	2.02
Use hairdryer	3.764	2.18
Exercising	3.745	1.77
Leave lights on at night	3.691	2.00
Preheat oven	3.679	2.20
Wash dishes	3.611	2.00
Buy sustainable goods	3.604	1.70

Use washing machine	3.566	1.95
Holiday abroad	3.527	2.14
Buy cheap clothes	3.519	1.69
Use compost bin for food	3.455	1.97
Disobey speed limit	3.434	1.90
Watch television	3.407	1.61
Buy organic food	3.283	2.00
Eat fruit & veg	3.236	1.88
Listen to music	3.204	1.86
Use mobile phone	3.056	2.02
Reuse plastic bags	3.055	1.90
Go to cinema	3.019	1.79
Use social media	3.018	1.76
Walking	2.926	1.73
Socialise	2.855	1.52
Eat in a restaurant	2.673	1.45
Playing sport	2.623	1.58